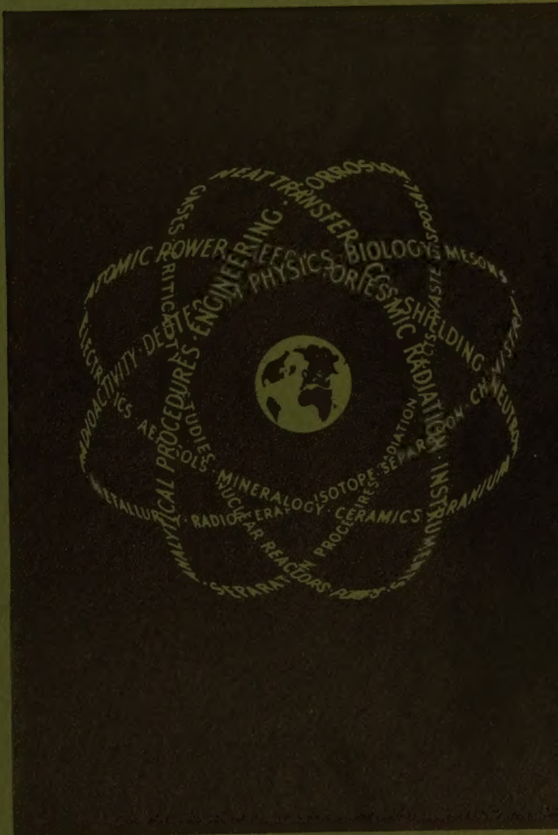
541
12

NUCLEAR SCIENCE ABSTRACTS

UNIVERSITY OF ILLINOIS
LIBRARY
SEP 15 1960
CHICAGO



July 31, 1960

Volume 14 Number 14
Abstracts 13523–14610

UNITED STATES ATOMIC ENERGY COMMISSION
Office of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U.S. that are abstracted in NSA.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennessee
Memphis, Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

NUCLEAR SCIENCE ABSTRACTS

A Semimonthly Publication of the United States Atomic Energy Commission Office of Technical Information

PURPOSE AND SCOPE

Nuclear Science Abstracts (NSA) serves scientists and engineers interested in the field of atomic energy by providing abstracts of the literature on nuclear science and engineering as well as immediate and detailed indexes to that literature.

NSA covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world-wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.

ARRANGEMENT OF ABSTRACTS

Abstracts are arranged according to broad subject categories as illustrated by the Contents (page iii). A new system of subject categories has been introduced in Volume 14.

INDEXES

Indexes in Individual Issues

Each issue of *NSA* includes personal and corporate author, subject, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short" titles of the items indexed. The Report Number Index provides information on the availability of the reports.

Cumulated Indexes

The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Vols. 1 through 4 (July 1948 – 1950) is included in the bound Vol. 4 which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($6.00). A subject and author index covering Vols. 5 through 10 (1951 – 1956) is available from the Superintendent of Documents ($5.25).

A cumulated report number index to *NSA* through Vol. 13 (1959) and to its predecessor, *Abstracts of Declassified Documents*, has been issued separately as report TID-4000, 5th Ed., *Public Availability of Reports Abstracted in Nuclear Science Abstracts*. This report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. ($5.00).

AVAILABILITY OF *NSA*

Sale

The semimonthly abstract issues and the four cumulated-index issues of *Nuclear Science Abstracts* are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

Semimonthly issues. Annual subscription rate: $18.00, domestic; $22.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.

Cumulated-index issues. Annual subscription rate: $15.00, domestic; $17.50, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange

NSA is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Journal articles, books, and other privately published materials are not available from the AEC. Detailed information on obtaining reports and translations is given in the introduction to the Report Number Index.

U. S. Patents

Copies of U. S. patents may be ordered from the U. S. Patent Office, Department of Commerce, Washington 25, D. C. ($0.25 per copy).

United Kingdom Patents

Copies of United Kingdom patents may be ordered from The Patent Office, 25, Southampton Buildings, London W.C.2, England ($0.49 per copy).

Use of funds for printing this publication approved by the Director of the Bureau of the Budget February 3, 1959.

CONTENTS

Volume 14, Number 14, July 31, 1960

Category	Abstract	Page
GENERAL AND MISCELLANEOUS	13523	1707
BIOLOGY AND MEDICINE		
General and Miscellaneous	13539	1709
Biochemistry, Nutrition, and Toxicology	13562	1713
Fallout and Ecology	13568	1713
Radiation Effects on Living Tissues	13576	1714
Radiation Sickness	13647	1724
CHEMISTRY		
General and Miscellaneous	13656	1725
Analytical Procedures	13686	1729
General Inorganic and Physical Chemistry	13712	1733
Radiation Chemistry and Radiochemistry	13749	1738
Raw Materials and Feed Materials	13771	1740
Separation Processes	13777	1741
ENGINEERING AND EQUIPMENT		
General and Miscellaneous	13808	1745
Heat Transfer and Fluid Flow	13819	1746
Instrumentation	13836	1749
Materials Testing	13917	1757
GEOLOGY, MINERALOGY, AND METEOROLOGY	13918	1757
HEALTH AND SAFETY	13942	1761
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	13979	1766
ISOTOPE SEPARATION	13989	1767
MATHEMATICS AND COMPUTERS	13995	1768

Category	Abstract	Page
METALS, CERAMICS, AND OTHER MATERIALS		
General and Miscellaneous	14001	1768
Corrosion	14025	1772
Fabrication	14035	1774
Properties and Structure	14049	1775
Radiation Effects	14123	1786
PHYSICS		
General and Miscellaneous	14147	1789
Astrophysics and Cosmology	14228	1799
Cosmic Radiation	14231	1799
Criticality Studies	14250	1802
Elementary Particles	14251	1802
Nuclear Properties and Reactions	14345	1812
Particle Accelerators	14457	1825
Plasma Physics and Thermonuclear Processes	14475	1827
Shielding	14522	1832
Theoretical Physics	14523	1832
REACTOR TECHNOLOGY		
General and Miscellaneous	14535	1833
Power Reactors	14553	1835
Production Reactors	14598	1842
Research Reactors	14599	1842
WASTE DISPOSAL AND PROCESSING	14604	1843
CORPORATE AUTHOR INDEX		INDEX-1
PERSONAL AUTHOR INDEX		INDEX-7
REPORT NUMBER INDEX		INDEX-41
SUBJECT INDEX		INDEX-47

Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

SUBJECT CATEGORIES IN NUCLEAR SCIENCE ABSTRACTS

Introduction

Abstracts in *Nuclear Science Abstracts (NSA)* are arranged according to a limited number of major categories and subcategories. Some of the major categories are based on scientific disciplines, e.g., BIOLOGY AND MEDICINE. Other categories, e.g., WASTE DISPOSAL AND PROCESSING and HEALTH AND SAFETY, have been established because of special or unique interests among the users of *NSA*. The large amount of literature in some subject areas, e.g., PHYSICS AND CHEMISTRY, has resulted in dividing the literature into subcategories.

The categories in an ideal system would be mutually exclusive. In practice, the categories cannot be so ideally defined, and frequently documents are not so neatly written so as to make possible mutual exclusiveness in categorization. The definitions of the major and subcategories given below were established for use beginning with *NSA*, Vol. 14, No. 14 (July 31, 1960).

The difference between theoretical or pure science and applied technology often determines the categorization. Thus, when the theory and design of an instrument is the main concern of the paper, it will be placed in the subcategory *Instrumentation* under ENGINEERING AND EQUIPMENT. An instrument which has the limited application is categorized according to the application, e.g., REACTOR TECHNOLOGY or the subcategory *Separation Processes* under CHEMISTRY. In a similar manner, papers on the pure chemistry of elements and compounds will be placed under CHEMISTRY, but applied chemistry will be categorized according to the application, e.g., the subcategory *Corrosion* under METALS, CERAMICS, AND OTHER MATERIALS. Also, information on computer codes written for and limited in use to specific applications is categorized according to the application rather than under MATHEMATICS AND COMPUTERS.

DEFINITIONS OF NSA CATEGORIES

GENERAL AND MISCELLANEOUS

Includes publications covering more than one of the major subject categories (e.g., broad-scope progress reports) and publications in subject fields not covered by the more specific major categories.

BIOLOGY AND MEDICINE

General and Miscellaneous

Includes information which logically falls under the main subject category but which is outside specific subcategories or is a combination of two or more subcategories.

Biochemistry, Nutrition, and Toxicology

Includes chemistry of living organisms, the absorption, metabolism, and utilization of materials ingested, inhaled, or otherwise absorbed by the organisms. Includes studies performed to establish maximum allowable concentrations. Limits for internal emitters and external radiation and for other toxic substances may be found under HEALTH AND SAFETY. The effects of radiation on living organisms are not included in this subcategory but may be found under *Radiation Effects on Living Tissues*.

Fallout and Ecology

Includes studies of the movement of radioactive and other materials through food chains and the effects of these materials on natural communities, and the measurement of radioactive materials in the biosphere and the implications in terms of potential hazard.

Radiation Effects on Living Tissues

Includes information of radiation effects on tissues, tissue cultures, organs, and unicellular organisms.

Radiation Sickness

Includes information on the physiological response of whole animals to radiation, and the prevention and treatment of radiation sickness. Information on protective measures other than prophylaxis is found under HEALTH AND SAFETY.

CHEMISTRY

Excluded from this category are: *Biochemistry*, which is found under BIOLOGY AND MEDICINE; *Corrosion*, which is under METALS, CERAMICS, AND OTHER MATERIALS; and *Geochemistry*, which is under GEOLOGY, MINERALOGY, AND METEOROLOGY.

General and Miscellaneous

Includes information which logically falls under the main subject but which is outside specific subcategories or is a combination of two or more subcategories.

Analytical Procedures

Both qualitative and quantitative procedures, including analysis by radiochemical means and mass spectroscopy.

General Inorganic and Physical Chemistry

Chemistry of salts, acids, and bases; physical properties of chemicals and the relation between energy and chemical change.

Radiation Chemistry and Radiochemistry

Includes chemical reactions and changes in chemical properties brought about by radiation, and the effects on chemical processing of the radioactivity of the materials being processed. Changes in living tissues brought about by radiations are found under *Radiation Effects in Living Tissues* under BIOLOGY AND MEDICINE. Radiation-induced changes, in physical properties of nonliving things, are found under *Radiation Effects* under METALS, CERAMICS, AND OTHER MATERIALS. The processing of irradiated reactor fuel and breeder materials is found under *Separation Processes*. Some radiochemical aspects of waste disposal are found under WASTE DISPOSAL AND PROCESSING.

Raw Materials and Feed Materials

Includes information on equipment, plants, and processes for the conversion of uranium and thorium ores to the metals or to intermediate compounds. Also includes the reduction to metal of uranium, plutonium, or thorium compounds on any scale.

Separation Processes

Includes the chemistry and chemical engineering processing (including pyrometallurgical methods) of reactor fuel and breeder materials for the separation of uranium, plutonium, and thorium from fission products. This subcategory also includes miscellaneous separation procedures but excludes the separation of uranium and other materials from ore concentrates and solutions which is categorized under *Raw Materials and Feed Materials*. The separation of isotopes of an element from a mixture of isotopes of the same element is found under ISOTOPE SEPARATION.

ENGINEERING AND EQUIPMENT

Includes information on equipment and instruments not specifically associated with processes, devices, or procedures included in other subject categories. Instruments which are integral components of reactor systems are categorized under REACTOR TECHNOLOGY, and instruments which have a unique application in a chemical separation process are categorized under the subcategory *Separation Processes* under CHEMISTRY.

General and Miscellaneous

Includes information which falls under the main subject category but which is outside specific subcategories or is a combination of two or more subcategories. Examples of information included are the design of laboratories and equipment such as remote control apparatus and specialized engineering techniques and equipment when the equipment and techniques are the primary subject rather than the application. Also includes engineering applications of nuclear explosions and simulated nuclear explosions.

Heat Transfer and Fluid Flow

Theoretical studies and engineering applications of heat transfer and fluid flow.

Instrumentation

Includes information on the design, testing, and uses of instruments where these aspects of instrumentation are the main subjects. Excluded is information on the specific applications of an instrument, which is categorized by the application.

Materials Testing

Limited to information primarily concerned with equipment, methods, and techniques for destructive or nondestructive testing of materials. When the material is of primary interest, information on testing, including corrosion and erosion, is found under METALS, CERAMICS, AND OTHER MATERIALS.

GEOLOGY, MINERALOGY, AND METEOROLOGY

Includes information on ore deposit exploration, economics of ore procurement, crystallography and geochemistry of minerals, uses of radiometric equipment and techniques in geological field and laboratory studies, radiometric age estimation of geological formations, atmospheric and weather conditions, climatology, general meteorological problems, and meteorological studies made for the purpose of obtaining information on the movement of airborne particulate matter.

HEALTH AND SAFETY

Includes critical limits for moving and storing fissionable, radioactive, and toxic materials; experience in applied health physics; limits for external and internal emitters; the development of and experience with personnel protection procedures; and general industrial and radiation hazards analyses. Excludes studies to establish maximum allowable concentrations and limits of exposure which are found under *Biochemistry, Nutrition, and Toxicology* under BIOLOGY AND MEDICINE.

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Includes only the application of isotopes and radiations to industrial processes. Applications of isotopes and radiations to basic research, e.g., biology, chemistry, are categorized according to the basic subject.

ISOTOPE SEPARATION

Includes information on the theory and methods of separating one or more isotopes of an element from a mixture of isotopes of that element.

MATHEMATICS AND COMPUTERS

Includes information on pure mathematics, statistics, and the design, development, and operation of computers. Information on applied mathematics and computer applications is categorized to the application; e.g., computers used as simulators of various devices and processes are categorized in the same manner as the device or process simulated; computer codes and applied mathematics are categorized on the basis of the application.

METALS, CERAMICS, AND OTHER MATERIALS

The term "Other Materials" refers to such substances as plastics, rubbers and other elastomers, wood, concrete, graphite, and petroleum.

General and Miscellaneous

Includes information which falls under the main subject category but which is outside specific subcategories or is a combination of two or more subcategories.

Corrosion

Includes corrosion and erosion studies which appear to be directed to specific applications. Excludes studies primarily concerned with physical chemistry, reaction kinetics, etc., which are categorized under CHEMISTRY.

Fabrication

Limited to fabrication methods, procedures, and equipment, including those for fuel elements and reactor components.

Properties and Structure

Includes mechanical, physical, and structural properties.

Radiation Effects

Includes effects of radiation on mechanical, physical, and structural properties. Chemical effects of radiation are found under *Radiation Chemistry* under CHEMISTRY.

PHYSICS

General and Miscellaneous

Includes information which falls under the main subject category but which either is outside specific subcategories or is a combination of two or more subcategories.

Astrophysics and Cosmology

Includes the origin and cosmic abundance of elements, isotopic composition of meteorites, stellar processes, etc.

Cosmic Radiation

Studies of the origin, intensity variations, acceleration processes, etc., of cosmic radiation. Excluded are studies on the properties of particular cosmic particles or in which cosmic radiation is used merely as a source of high-energy particles which are found under either *Elementary Particles* and *Radiations* or *Nuclear Properties and Reactions*, depending on the emphasis.

Criticality Studies

Includes basic studies of nuclear criticality. Critical limits of movement and storage of radioactive materials are found under HEALTH AND SAFETY. Criticality studies pertaining to reactors are found under REACTOR TECHNOLOGY.

Elementary Particles and Radiations

Includes properties and theory, including interactions with each other. The diffusion of particles and radiations in shielding materials and configurations is found under *Shielding*.

Nuclear Properties and Reactions

Includes experimental and theoretical studies relating to properties, reactions, and interactions of nuclei.

Particle Accelerators

Includes the theory, design, development, construction, and operation of high-voltage machines and particle accelerators.

Plasma Physics and Thermonuclear Processes

Includes phenomena of electric discharges; fundamental plasma experiments and theory; theory, design, development, and experimentation relating to controlled release of energy from thermonuclear reactions; and research and theory on electro- and magnetodynamics applicable to plasma studies and thermonuclear processes.

Shielding

Limited to theoretical and experimental studies such as those relating to the diffusion, attenuation, absorption, and scattering of particles and radiations in shielding materials and configurations. Excluded is information concerned only with the fabrication of shielding materials and configurations which is found under *Fabrication* under METALS, CERAMICS, AND OTHER MATERIALS.

Theoretical Physics

Theoretical studies which cannot be categorized more specifically, e.g., quantum mechanics.

REACTOR TECHNOLOGY

Includes information on the theory, design, construction, and operation of fission reactors.

General and Miscellaneous

Includes information which falls under the main subject category but which is outside specific subcategories or is a combination of two or more subcategories; general studies on reactor theory, design, construction, and operation of reactor components and auxiliaries; and reactor criticality studies not applicable to specific reactors. Information of this nature, including safeguard studies, that applies to a specific type of reactor is found under the appropriate type of reactor listed below.

Power Reactors

Includes information on reactors used primarily for the production of power. Also includes power-breeder, propulsion, and process-heat reactors.

Production Reactors

Includes information on reactors used primarily for the large-scale production of special nuclear materials and radioisotopes.

Research Reactors

Includes information on reactors and assemblies used primarily as a source of neutrons for the purpose of conducting experimental studies, and for training.

WASTE DISPOSAL AND PROCESSING

Includes the chemistry and chemical engineering processing for the storage, disposal, and control of radioactive waste materials, including the treatment of waste materials prior to disposal such as concentration, neutralization, filtration, or calcination. Safety aspects of radioactive waste handling and disposal are found under HEALTH AND SAFETY. Ecological aspects of waste materials are included in *Fallout and Ecology* under BIOLOGY AND MEDICINE. Some radiochemical aspects are included in *Radiochemistry* under CHEMISTRY. Processing of fuel elements is placed under *Separation Processes* under CHEMISTRY.

NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 14 July 31, 1960

GENERAL AND MISCELLANEOUS

13523 AECL-971
Atomic Energy of Canada Ltd., Chalk River, Ont.
PAPERS PRESENTED BY A.E.C.L. TO THE FIRST CANADIAN CONFERENCE ON URANIUM AND ATOMIC ENERGY, HELD AT TORONTO, ONTARIO, JANUARY 11-13, 1960. J. L. Gray, G. C. Butler, R. F. Errington, and G. C. Laurence. Feb. 1960. 57p. AECL.

Five papers presented by AECL at the Canadian Conference on Uranium and Atomic Energy held at Toronto, Jan. 1960, are contained. Separate abstracts were prepared for the five papers. (W.D.M.)

13524 AECL-971(p.1-16)
Atomic Energy of Canada Ltd., Chalk River, Ont.
A WORLD REVIEW OF NUCLEAR POWER. J. L. Gray. 16p.

The status of the nuclear power development programs throughout the world is briefly summarized. The Canadian program is discussed in more detail. (W.D.M.)

13525 AECL-971(p.17-20)
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE FUTURE OF NUCLEAR POWER IN CANADA. G. C. Laurence. 4p.

A brief discussion of the future of nuclear power in Canada through the 1970's is presented. An attempt is made to justify economically the choice of heavy-water moderation for the Canadian program. (W.D.M.)

13526 AECL-971(p.21-4)
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE FUTURE OF THE CANADIAN NUCLEAR MANUFACTURING INDUSTRY. J. L. Gray. 4p.

The future role of Canadian industry in nuclear power development is briefly discussed. The AECL-industry relationship is outlined. (W.D.M.)

13527 AECL-971(p.37-53)
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE USES OF RADIOISOTOPES. R. F. Errington. 17p.

The production, control, and methods of measurement of radioisotopes are reviewed. Applications in agriculture, medicine, industry, geology, and other uses are described. Canada's role, both past and future, in pioneering uses for radioisotopes is discussed. (W.D.M.)

13528 HW-62638
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
QUARTERLY PROGRESS REPORT ON RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, JULY-SEPTEMBER 1959. Nov. 5, 1959. 38p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the effect of fission products in reactor effluent on young rainbow trout; the pathological effects of iodine-131 in laboratory animals; determinations of the body burdens and effects on gonads of cesium-137 and zinc-65; the pathological effects of plutonium-239; the effects of age and DTPA therapy on plutonium toxicity in rats; the uptake of fission products by plants; monitoring of beta radioactivity in Columbia River fish; studies on meteorological dispersion using fluorescent pigment tracer particles; the development of radiation monitoring instruments; measurements of radioactivity in reactor effluent; ground waste investigations; environmental monitoring activities; and experiments on the oxidation of uranium and volatilization of fission products. One hundred thirty-six people were measured at the Shielded Personnel Monitoring Station. Results are discussed. (For preceding period see HW-61247.) (C.H.)

13529 TID-3522(3rd Rev.)
Technical Information Service Extension, AEC.
PEACEFUL USES OF NUCLEAR EXPLOSIONS. A Literature Search. Hugh E. Voress, comp. Apr. 1960. 8p. OTS.

A list of selected literature references on industrial uses of nuclear explosions is presented. Seventy-one references to report and published literature to April 1960 are included. (J.R.D.)

13530 TID-4000(5th Ed.)
Technical Information Service Extension, AEC.
PUBLIC AVAILABILITY OF REPORTS ABSTRACTED IN NUCLEAR SCIENCE ABSTRACTS. BOOK 1 AND 2. Feb. 1960. (Issued in two books: 327p. (Bk 1) and 317p. (Bk. 2)). OTS.

A listing in alpha-numeric order of all reports which are abstracted in Nuclear Science Abstracts (NSA), Vols. 1 through 13, and its predecessor Abstracts of Declassified Documents (ADD) is presented. The report number, the corresponding NSA or ADD volume and abstract number, and a notation regarding the latest known avalability are given. Prices and types of copy available are also included. (J.R.D.)

13531 UCRL-9041
California. Univ., Berkeley. Lawrence Radiation Lab.
BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1959. Edward L. Bennett, ed. Dec. 21, 1959. 61p. Contract W-7405-eng-48. OTS.

Centrifugally accelerated paper chromatography for the separation of chloroplast pigments gave results similar to those of conventional paper chromatographic methods. This technique appears to be very promising for the separation and recovery of the labile chlorophylls and carotenoids because of the narrowness and compactness of the pigment zones and the rapid development time. The pigments were easily eluted from the paper and recovery was greater than from the usual paper chromatograms. PGA-1-C^{14} was found to be readily reduced by a sonically ruptured chloroplast system in light. This reduction is inhibited by threose 2,4-diphosphate. PGA accumulates when $C^{14}O_2$ is incubated in light with the sonically ruptured chloroplast system in the presence of threose 2,4-diphosphate. This indicates that PGA is in the major pathway of photosynthetic CO_2 fixation in the system. Threose diphosphate inhibition of the total $C^{14}O_2$ fixation by the carbon cycle of sonically ruptured spinach chloroplasts is not due to inhibition of carboxydismutase, but due primarily to inhibition of triose phosphate dehydrogenase which in turn limits the formation rate of the photosynthetic carbon cycle CO_2 acceptor, RuDP. Plants of Papaver somniferum were grown in the presence of $C^{14}O_2$ for 2-hr, 6-hr, and 8-day periods after which labelled morphine, codeine, and thebaine were isolated. Investigations were made of the carbonaceous material in meteorite Murray. Data are tabulated. Strain differences were demonstrated in acetyl choline concentration in rat brain. Investigations were made of the time dependence of the formation of unpaired electrons in aromatic hydrocarbon systems; the proton magnetic resonance in simple polypeptides; the occurrence of manganese phaeophytin in plants; and studies of hydrogen bonding by nuclear magnetic resonance. (For preceding period see UCRL-8961.) (C.H.)

13532

NEW NUCLEAR ENERGY ESTIMATIONS FOR EUROPE. H. W. Oberlack. Atom u. Strom 6, 23-7(1960) Mar. (In German)

In the past five years the estimation of the development possibilities and the future significance of nuclear energy in Europe has changed considerably. This is probably caused by the change in the estimation of the energy needs of western Europe. A survey of the latest estimations is presented. (J.S.R.)

13533

ATOMIC ENERGY BETWEEN STATE AND PRIVATE ECONOMY. Atom u. Strom 6, 28-31(1960) Mar. (In German)

The participation of the state and private industry in the development of atomic energy in Europe is considered. The role of each in Belgium, German Republic, France, Italy, Netherlands, Norway, Austria, Portugal, Spain, Sweden, Switzerland, and the United Kingdom is listed. (J.S.R.)

13534

CESIUM-ION PROPULSION. ION MOTORS FOR SPACECRAFT APPPEAR WITHIN THE REACH OF PRESENT-DAY TECHNOLOGY, BUT GEOMETRICAL DESIGN AND DEVELOPMENT TESTS POSE DIFFICULT TECHNICAL PROBLEMS. A. T. Forrester and R. C. Speiser (Rocketdyne Div., North American Aviation, Inc., Canoga Park, Calif.). Astronautics 4, 34-5; 92-7(1959) Oct.

Surface ionization of cesium and acceleration of the ions are discussed as a means of propulsion for space vehicles with exhaust velocities (v) of 4×10^6 to 2×10^7 cm/sec. Surface ionization is attractive because of its simplicity and cesium is preferable because its heavy weight is advantageous. In such a motor, cesium is delivered to a porous tungsten sheet through which it diffuses and then is thermally ionized on the surface and accelerated into space, passing the accelerating and exit electrodes. The exit electrode is also an electron emitter for charge neutralization purposes. Alternative designs and the reasons for their rejection are given. Pore size of the tungsten sheet is discussed at length because it determines the extent of ion scattering by neutral atoms and hence the power efficiency; current densities are plotted vs temperature and power loss for two pore sizes, 1 and 2 μ. A power efficiency of 98% is possible at $v = 2 \times 10^7$ cm/sec and a current density of 7 ma/cm^2, but at lower v the efficiency decreases. Since total currents must be variable (4 amp or more), the accelerating system must be a large array of long slits. A relationship between current, voltage, and slit width is given, and sets of operating parameters for ion motors are calculated therefrom and tabulated. A test ion motor set up in a laboratory gave 50% delivery of the consumed cesium as ions to the collector, and its ion beam was observed to have oscillations of frequency varying with the $^1/_4$ power (expected $^1/_2$) of the current. The problems incident to design and construction of ion motor rockets, e.g., alignment, ion scattering data, and neutralization of charge, are discussed. It is concluded that development of cesium ion motors for space propulsion is feasible and susceptible of success. (D.L.C.)

13535

ATOMIC ROCKETS FOR ASTRONAUTICS. E. Sänger (Forschungsinstitut für Physik der Strahlentriebe e.V., Stuttgart-Flughafen). Astronaut. Acta 6, 1-15(1960). (In German)

Among the various modes of nuclear reactions such as fission, fusion, and conversion of matter to radiation only the first is presently utilizable for atomic rockets. Among the various fission rockets, such as convective, electric, hot water, and photonic, only the first two are presently being industrially developed, but the other two deserve special attention since they are conducive to higher travel performances. Equations of the rocket velocity for various modes of propulsion and destinations are given and plotted. (auth)

13536

CHEMICAL PROTECTION FROM RADIATION EFFECTS. Donald R. Kalkwarf (General Electric Co., Richland, Wash.). Nucleonics 18, No. 5, 76-81; 130-1(1960) May.

The effectiveness of chemicals in reducing radiation damage was investigated. Hypothetical and confirmed mechanisms which increase or decrease radiation effects are: energy and charge transfer from an excited molecule to an additive molecule; scavenging additives reacting with decomposition products from molecules; and complex-forming additives, the product of which is more or less susceptible to radiation than the original substance. Cysteine was one of the first compounds reported to protect living systems. The thiol and amine groups of this molecule have been the focus of much interest. It has been pointed out that beta-substituted ethylamine groups are common to a number of good protective agents in mice. Compounds like $HS-(CH_2)_x - NR_1R_2$ offer biological protection if x does not exceed 3, and R_1 and R_2 are alkyl substituents. The protective action of aminoalkylisothiuronium salts depends on their ability to rearrange into the corresponding mercaptoalkylguanidines in which a thiol (-SH) group is exposed. These compounds increase the mean longevity of animals, prevent induction of leukemia, and protect against death; they do not prevent nephrosclerosis, loss of fur color, or cataract formation. Cysteamine protects animals from death following an acute radiation dose but does not protect against genetic damage or sterility. Some of the most active industrial investigations of chemical protection have been on lubricants for nuclear-powered equipment. Chemical protection was investigated for decreasing the radiation effects on elastomers and plastics, glass, ion-exchange resins, the sterilization of food and medicinal products, and radiation-induced reaction products. (B.O.G.)

13537
THE ATOMIC ENERGY RESEARCH AND DEVELOPMENT PROGRAMME OF SOUTH AFRICA. A. J. A. Roux (Atomic Energy Board, Pretoria). *S. African Inst. Mech. Engrs. J.* [*9*,] 103-26(1959) Dec.

The South African research and development program covers three main aspects—raw materials, nuclear power, and radioisotopes. In the materials field the objectives will be to improve the mining and extraction of uranium, to investigate the possibility of further processing of uranium concentrates, and to increase the output or to start production of other reactor materials, e.g., thorium, beryllium, hafnium, niobium, and zirconium. The program will be aimed at keeping in contact with developments overseas, assessing the value of nuclear power under local conditions, and making some contribution toward research and development. Every effort will be made to increase the use of radioisotopes by instituting training courses and extending services to users. Research will be undertaken to discover new uses for isotopes. A research reactor is required, and it has been decided to purchase a reactor with a thermal neutron flux of about $5 \times 10^{13} \cdot$ n/cm^2-sec. The program will be carried out by the Atomic Energy Board using, wherever possible, existing facilities at other organizations. The cost for the first five years is estimated at £800,000 p.a. of which the Government will contribute £290,000 p.a. and industry has agreed to contribute £471,000 p.a. so far. (auth)

13538
NUCLEAR POWER AND ITS APPLICATION UNDER SOUTH AFRICAN CONDITIONS. A. J. A. Roux (Atoomkragaad, Merinogebou, Pretoria). *Tegnikon* *12*, 92-100(1959) Oct. (In Dutch)

As an introduction to the consideration of the application of nuclear power in South Africa, the importance of nuclear energy as a power source and the present state of power reactor technology are considered. The costs of nuclear power stations in South Africa and the impact of nuclear power on the economy are discussed. The factors affecting its utilization in South Africa and the legal status are then discussed. (J.S.R.)

BIOLOGY AND MEDICINE

General and Miscellaneous

13539 AECU-4703
Woods Hole Oceanographic Institution, Mass.
BIOLOGICAL, CHEMICAL AND RADIOCHEMICAL STUDIES OF MARINE PLANKTON. Appendices to Reference No. 60-6 conducted during the Period May 15—December 31, 1959. Feb. 15, 1960. 159p. Contract AT(30-1)-1918. OTS.

The new oceanographic research required to evaluate radioactive waste disposal in the sea will include contributions from the disciplines of physical, chemical, geological, and biological oceanography. Since the return of radioactivity to man will be principally through the biological cycle, the studies in marine biology will be emphasized. Problems are concerned with the disposal of low-level wastes in inshore coastal waters or estuaries and with the disposal of higher-level wastes in the open sea. Marine pollution problems in the North Atlantic are discussed. Data are presented from studies on plankton, oxidizable organic matter in the oceans, seasonal mixing in the ocean waters, strontium-90 from fall-out in the mixed layer of the Atlantic Ocean, and miscellaneous oceanographic research studies. (C.H.)

13540 ANL-6093
Argonne National Lab., Lemont, Ill.
BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMI-ANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. Dec. 1959. 110p. Contract W-31-109-eng-38. OTS.

Progress is reported in the following studies: the control of a scabies-like mange of rats and pinworms in mice; *in vivo* measurement of Sr^{90} in dogs; the effects of the chronic ingestion of Sr^{90} in mice; investigation of the tritium labeling of organic compounds by the self-irradiation method; the delayed effects of x irradiation in chickens; development of a new method for the assay of enzymatic activity of various homocysteine transmethylases; the use of a punched-card system for the location of filed prints of electron micrographs; the specific chromosomal control of the mass of the nucleolus and of the cytoplasm in plants; the effect of deuterium oxide on peripheral blood cells in rats; spermatogenesis in irradiated mice; the development of mathematical models for the maintenance and regulation of populations of blood cells of both erythroid and myeloid origin; the effect of boron on the uptake of iron, copper, manganese, and molybdenum in a monocatyledonous plant, the grass *Setaria spacelata*; the photoperiodic behavior of sunflowers; the morphology of the mitotic spindle and chromosomes as seen under the interference microscope; the thirty-day survival of female mice and rats given single whole-body exposures to fission neutrons; the effectiveness of combined therapy with cysteine, bone marrow cells, and streptomycin and of cerbartrol, a bone marrow extract, against radiation injuries in mice; the biological effects of gamma radiation in mice and fission neutrons in chick embryos; modification of the membrane filter technique for studies of radiation effects in bacterial spores; Sr^{85} retention by the rat as a function of age at injection; the kinetics of granulocyte production in the normal dog; sedimentation rate studies; the effect of three polyamino acid chelating agents on acute experimental lead poisoning in rats; the treatment of radiostrontium poisoning by means of a diuretic, acetazolamid; the preparation and properties of toxohormone from tumors; the potentiation of tumor radiosensitivity; the fractionation of cholesterol esters by silicic acid chromatography; and the bacterial metabolism of unsaturated fatty acids. (For preceding period see ANL-5916.) (C.H.)

13541 CEA-1216
France. Commissariat à l'Énergie Atomique, Paris and Hôpital Des Enfants Malades, Paris.
ETUDE A L'AIDE DES ISOTOPES ^{131}I ET ^{15}N D'UN CAS D'HYPOPROTEINEMIE ESSENTIELLE. (Study of a Case of Essential Hypoproteinemia Using the Isotopes I^{131} and N^{15}). A. Dubert, J. Coursaget, P. Fallot, and P. Royer. 1959. 11p.

Hyoproteinemia both human and experimental has been studied with the help of nuclear labelling. A comparative study has been made of the fate of serum proteins labelled by an endogenous path after administration of nitrogen-15 glycine and also of serum albumin labelled by the exogenous path using iodine-131. The biological period of the serum albumin and serum globulins and also the magnitude of the vascular and extravascular pools of serum albumin were determined. In this way it was possible to measure the speed of replacement of plasma proteins. A presentation of results taken from both clinical observation and experiment leads to a discussion on the pathogenic mechanism of hypoproteinemia. (auth)

13542 CEA-1364
France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDES CINÉTIQUES D'ÉCHANGES D'IONS DANS LES OUTREMERS PAR LA TECHNIQUE DES TRACEURS RADIOACTIFS. (Kinetic Ion Exchange Studies in Ultramarines by the Radioactive Tracer Method). S. May, H. Goenvec, and G. Pinte. 1960. 27p.

The possibility of ion exchanges in various ultramarines has been studied in the aqueous phase. The kinetics of the exchange reactions is followed by studying the behavior of a radioactive ion, either in the solution of the exchanging salt or in the ultramarine itself. The sodium in the make-up of the ultramarine is found to exchange with various ions in solution. The reaction speeds appear to be governed by a diffusion process inside the grains of ultramarine. The diffusion coefficients and the activation energies are determined for the exchange studied. Several exchange studies were carried out in an organic medium. The kinetics of ion exchange is also investigated in ultramarines from which most of the constituant sulfur has been eliminated. The results obtained in these ultramarines are compared with the exchange kinetics of the same ions in ordinary ultramarine. (auth)

13543 TID-5709
Columbia-Presbyterian Medical Center, New York.
STUDY OF THE CONDENSING UNITS IN NUCLEIC ACID BIOSYNTHESIS. Report of Activities for June 1, 1959–May 31, 1960. T. Duane Price. Feb. 29, 1960. 32p. Contract AT(30-1)-2208. OTS.

Activities of a research program designed to elucidate the mechanisms of nucleic acid biosynthesis in live animal and human tissue are reported. Experiments were conducted in which tissue (in vivo) was subjected to short-time incubation periods with P^{32} labeled phosphate. Heterogeneous P^{32}-labeling of 5′-nucleotide precursors was the result of experiments with human and rat liver. In a short time after injection the adenosine 5′-phosphate is highly labeled while nucleoside 5′-phosphates are only slightly labeled, and those to different extents. Predictions of isotope distribution in nucleic acids formed directly from these compounds or from corresponding nucleoside 5′-polyphosphates having carbon-bound P groups with specific activity equal to that of cognate nucleoside 5′-monophosphates were true in cases of rat liver ribonucleic acid. These predictions were found to be partially fulfilled in cases of rat liver cytoplasm ribonucleic acid. Studies not yet completed indicate that the results on ribonucleic acid of rat liver cytoplasm are a consequence of relatively fast and specific exchange reactions occurring at the end of cytoplasmic ribonucleic acid molecules bearing free 3′-OH groups. Another study is in progress to determine if non-terminal parts of cytoplasmic ribonucleic acid are derived from nuclear ribonucleic acid. A description of proposed research is included. (J.R.D.)

13544 UCLA-457
California. Univ., Los Angeles. School of Medicine.
SEMIANNUAL PROGRESS REPORT FOR THE PERIOD ENDING DECEMBER 31, 1959. 107p. Contract AT-04-1-GEN-12. OTS.

A list is presented of publications and reports issued during the period. Progress is reported in the following studies: the radiation chemistry of dilute aqueous potassium oleate, ferriprotoporphyrin, ferrous Dowex-50 resin, and papain; the reaction of ferriprotoporphyrin with hydrogen peroxide; the effects of x radiation on cellular inclusions in chicken embryo livers; the effects of tritiated compounds on Escherichia coli; the late effects of whole-body x irradiation in rats following fractionation of x-ray dosage and following partial-body shielding; the resistance to x radiation of embryonic cells of the limb buds of tadpoles; effects of x radiation upon spontaneous and evoked brain electrical activity in cats; thiamine transport across irradiated isolated rat intestine; the effect of Sr^{90} beads within the rat femur; effects of irradiation on lymphocytes in freshly drawn blood; the synthesis of polyunsaturated fatty acids by fish; the isolation and cultivation of single beating heart cells from the rat heart; the toxicity of hafnychloride; the effect of time between treatment and exposure and the effect of the rate of exposure on radioprotective action on mice of doses of 2-aminoisothiuronium-Br-HBr (AET) combined with 5-hydroxytryptamine creatinine sulfate (5-HT); the effects of nucleic acid preparations from leukemic mouse cells on the incidence of leukemia in mice; the demonstration of the superiority of Hippuran over Diodrast and other similar preparations as a test material for use in renograms; phantom studies on renogram techniques; the development of tracer techniques for use in clinical studies on kidney function; blood and plasma volume measurements, liver function, and hepatic blood flow; the metabolism of Sr^{90} in humans; the effects of calcium on skeletal deposition of Sr^{85} and Ca^{45} in rats; the nature and quantitative consistency of the biological response to intravenously administered colloidal gold for the development of test procedures to estimate minimum liver blood flow and phagocytic capacity of the reticuloendothelial system; measurements of liver blood flow using colloidal Au^{198}; and the disappearance of injected phosphorus-32 labeled phosphates in the brains of mice. Studies on environmental radiation included the development of a granular collector for sampling fall-out debris from nuclear detonations; studies on the biological availability of fall-out originating from continental detonations; environmental and soil factors influencing the uptake of fission products by plants; an assessment of environmental contamination emitted by nuclear propulsion devices, and measurements of the Sr^{89} and Sr^{90} content of caribou and moose antlers from Alaska. Design modifications are described for several radiation detectors. Progress is reported in the development of chemical methods for the dosimetry of thermal neutrons. (For preceding period see UCLA-444.) (C.H.)

13545 UR-567
Rochester, N. Y. Univ. Atomic Energy Project.
EXPERIMENTAL RADIATION THERAPY OF TUMORS USING I^{131} CARRYING ANTIBODIES TO FIBRIN. William F. Bale, Irving L. Spar, and Ruth L. Goodland. Mar. 25, 1960. 25p. Contract W-7401-eng-49. OTS.

Antibody to rat fibrin, prepared from immunized rabbits, and made radioactive by in vitro coupling with I^{131}, localized with considerable specificity in several transplantable rat tumors after intravenous injection into rats bearing these tumors. Intravenous doses of 1.22 to 4.13 millicuries of I^{131} attached to rat fibrin antibody, injected into rats bearing the transplantable Murphy-Sturm lymphosarcoma after the tumors had grown to 2 to 3 grams in weight, consistently resulted in rapid and permanent regression of these tumors. (auth)

13546 UR-568
Rochester, N. Y. Univ. Atomic Energy Project.
HIGH SPECIFIC ACTIVITY IODINATION OF GAMMA-GLOBULIN WITH IODINE-131 MONOCHLORIDE. Ralph W. Helmkamp, Ruth L. Goodland, William F. Bale, Irving L. Spar, and Letitia E. Mutschler. Mar. 25, 1960. 18p. Contract W-7401-eng-49. OTS.

A technique was developed for introducing I^{131} into 4 mg amounts of antibody or γ-globulin protein at a level of 10 millicuries I^{131} per milligram protein with a resulting iodine content of 2 to 3 atoms per protein molecule of 160,000 molecular weight. The I^{131} was adjusted to pH 8 with borate buffer and the requisite amount of hydrochloric acid. To this solution was added Na_2SO_3 to destroy H_2O_2 produced by I^{131} β-radiation. Excess sulfite was oxidized by aerating the solution in a boiling water bath. On the addition of iodine monochloride to the cooled solution, $I^{131}Cl$ (or HOI^{131}) was produced by exchange, and following the rapid addition of this solution to protein, also in pH 8 buffer, coupling of approximately 60% of the I^{131} to protein occurred. When 10 mc or less of I^{131} was used, the addition of Na_2SO_3 and the aeration was omitted and a yield of about 60% of I^{131} attached to protein was still obtained. (auth)

13547 UR-569

Rochester, N. Y. Univ. Atomic Energy Project. DISTRIBUTION OF INJECTED I^{131} LABELED ANTIBODY TO DOG FIBRIN IN TUMOR-BEARING DOGS. Irving L. Spar, William F. Bale, Ruth L. Goodland, George W. Casarett, and Sol M. Michaelson. Mar. 25, 1960. 13p. Contract W-7401-eng-49. OTS.

Radioiodine-labeled antibody to dog fibrin was prepared and injected intravenously into 28 dogs with spontaneous tumors. The I^{131} content of tumor tissue was determined 3 days later. Most tumors showed no preferential concentration of I^{131}. In a few instances preferential I^{131} localization was found, and in at least one tumor it was great enough to suggest that if similar localization occurs in some types of human cancer, highly radioactive antibody of this type might be a useful tool for selective radiation of malignant tumor tissue. (auth)

13548 JPRS-2453

A METHOD OF TAGGING INSECTS BY GIVING THEM RADIOACTIVE ISOTOPES WITH FOOD. G. D. Khudadov. Translated from Byull. Moskov. Obshchestva Ispytateleĭ Prirody, Otdel Biol. 64, No. 3, 35-45(1959). 21p. OTS.

A study was made to determine the best method of labeling insects using radioactive food. Flies and roaches were used in the study which compared P^{32}, Ca^{45}, Fe^{59}, Zn^{65}, Sr^{89}, Y^{91}, Cd^{115}, I^{131}, Ba^{140}, and La in various food preparations. It was found that a 24-hr exposure was required for 100% tagging, the best results being obtained with P^{32} in a mixture of 3 parts milk and 1 part 10% sugar water. A direct relation was found between P^{32} concentration in food and the radioactivity of the flies, and the females were twice as radioactive as males, being twice as heavy. The effects of elimination, isotope decay, and energy of the emitted ray were considered. Radioisotopes with a beta above 0.8 Mev and a half life not less than 1 week are suitable. The food for studies running 10 to 20 days should contain 1 to 3 microcuries. (T.R.H.)

13549 JPRS-2531

PROBLEMS OF BIOLOGY IN COSMIC FLIGHT. V. B. Malkin. Translated from Priroda 48, No. 10, 35-44(1959). 20p. OTS.

The works of Tsiolkovskii in space medicine and rocketry around the turn of the 20th century are reviewed and discussed in relation to recent developments. (T.R.H.)

13550

RADIOTHERAPY WITH KILOCURIE SOURCES. H. Oppenberg (Gesellschaft zur Förderung der kernphysikalischen Forschung e.V., Cologne and Medizinischen Universitätsklinik, Cologne). Atomkernenergie 5, 141-3(1960) Apr. (In German)

The history of curie-teletherapy is reviewed briefly. Based on current literature and personal experience in the USA, clinical and technical aspects of various radioactive isotopes used in teletherapy are discussed. An increase in cure rates is expected by authoritative workers in this field. It is stressed, however, that clinical judgement and abilities can not be substituted by more powerful machines. (auth)

13551

THE PREPARATION AND PURIFICATION OF TRITIUM-LABELLED HEXOESTROL OF VERY HIGH SPECIFIC ACTIVITY ON THE 5 mg. SCALE. R. F. Glascock and G. S. Pope (Univ. of Reading, Penna.). Biochem. J. 75, 328-35(1960) May.

An apparatus for the catalytic hydrogenation of unsaturated organic compounds on the scale of 50 μ moles is described. It is used for the hydrogenation of dienoestrol with hydrogen containing up to 97% of tritium, when a product of specific activity 118 mc/mg is obtained. A method for the separation of the isomeric products hexoestrol and isohexoestrol on alumina-impregnated paper is given together with a column-partition method for the further purification of the separated hexoestrol from unlabelled impurities derived from the paper. A spectrophotometric method for the detection of unchanged dienoestrol in the reduction products to a lower limit of 2% is also described. Hydrogen uptake usually ceases within a few hours, when it is found that the theoretical volume of hydrogen (± 2%) has been taken up and less than 2% of unchanged dienoestrol remains in the reaction mixture. (auth)

13552

INVESTIGATION OF TRITIUM OXIDE METABOLISM IN ORGANISMS. K. M. Bogdanov, M. I. Shal'nov, and Yu. (Iu.) M. Shtukkenbyerg. Biophysics (U.S.S.R.) (English Translation) 4, No. 4, 58-67(1959).

The half time of 5 to 7 days for mice and rats with single administration of tritium apparently characterizes the rate of renewal of the structural elements of the internal organs and tissues. There are findings to the effect that in rats the period of semirenewal of the proteins of the plasma and internal organs is 6 to 7 days. In reality the exchange of hydrogen in the body occurs between a whole number of tissue structural elements. The solution of this problem mathematically entails great difficulties and the expressions obtained are not easy to compare with the experimental findings owing to the large number of parameters involved. In order to solve a number of practical problems it is sufficient to use the equations given describing the exchange of hydrogen between the water and the dried residue as a whole. The dynamics of tritium metabolism in the water phase of the body and in the structural elements of organs and tissues were studied with single acute administration of tritium oxide. New methods were devised for extracting the tritium from the water phase of the organism and from the structural elements of organs and tissues. Differential equations were composed describing the patterns of tritium metabolism in the living organism, and yielded solutions which are in agreement with experimental findings. (auth)

13553

USE OF RADIOACTIVE CESIUM IN THERAPY. F. Barbaccia (Ospedale Maggiore, Milan). Energia nucleare (Milan) 7, 233-8(1960) Apr. (In Italian)

A short survey of the characteristics of radiations emitted by Cs^{137}, particularly of the behavior of percentage transmission-rate of the gamma radiation, is presented. The limits and possibilities of using this radionuclide in therapy, especially in comparison with Co^{60} and x-rays, is indicated. (auth)

13554

STUDIES ON DEOXYRIBONUCLEIC ACID AFTER EXPOSURE TO TRITIUM GAS. Ellen Borenfreund, Herbert S. Rosenkranz, and Aaron Bendich (Cornell Univ. Medical Coll., New York). J. Mol. Biol. 1, 195-203(1959).

Deoxyribonucleic acid (DNA) from human leukocytes was exposed to 0.39 atm. of tritium (2.4 curies) for 14 days at room temperature, and approximately 0.1% replacement of hydrogen by tritium was effected. The molar ratios of tritium in the bases was adenine 1.0, thymine 9.8, guanine 1.4, and cytosine 2.4. The treatment caused a drop in average molecular weight from 5.2 to 1.3×10^6 as estimated from sedimentation data and there was a concomitant alteration in the anion exchange chromatographic behavior. Evidence was also obtained for some aggregation in addition to the degradation. These macromolecular changes did not appear to be accompanied by significant denaturation. (auth)

13555

POSITRON-SCANNING WITH COPPER-64 IN THE DIAGNOSIS OF INTRACRANIAL LESIONS. PARTITION OF COPPER-64 VERSENATE IN, AND EXCRETION FROM, THE BODY. H. James Bagnall, Philippe Benda, Gordon L. Brownell, and William H. Sweet (Harvard Medical School, Boston and Massachusetts General Hospital, Boston). J. Neurosurg. 15, 411-26(1958).

Copper versenate injected intravenously in man achieves within 2 hours concentrations in metastatic tumors about 9 times and in more rapidly growing gliomas about 5 times those in normal brain. Concentrations of copper in muscle rise steadily whereas those in tumor and normal brain fall. Copper scanning, best carried out within an hour of injection, has detected about 55 per cent of a random series of intracranial tumors. In the same patients arsenic scans detected 76% of the tumors. However, some tumors were detected by copper in which the arsenic failed. Vascular lesions of the brain are less likely to yield a positive scan with copper than with arsenic. About 5% of an intravenously injected dose of copper versenate is excreted in the urine. The rest largely undergoes physical decay of its activity before excretion occurs. The Cu^{64} activity injected for a diagnostic scan gives a whole-body radiation dosage of 0.33 rad, which is about the weekly permissible dose for personnel constantly exposed to radiation. Hence, this diagnostic maneuver may be repeated several times with impunity. (auth)

13556

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. PART I. Johannes Meissner. Kerntechnik 2, 91-5(1960) Mar. (In German)

A survey of the application of radioisotopes in biology and medicine considers first the indicator method and then irradiation techniques. In this first part, as an example, some biological questions were discussed which could be examined in detail by the application of isotopic tracers. Distribution studies in an organism and metabolism studies were treated in this connection. (tr-auth)

13557

ON THE PROBLEM OF THE APPLICATION METHOD OF RADIATION THERAPY. A. F. Bogoyavlenskiĭ, I. F. Bogoyavlenskiĭ, V. F. Bogoyavlenskiĭ, and L. S. Rachevskaya (Kirov Military Medical Academy of Order of Lenin, USSR). Med. Radiol. 5, No. 3, 47-51(1960) Mar. (In Russian)

Application methods of radiation therapy are discussed and the use of metallic applicators are advocated. (auth)

13558

REMOVAL OF STRONTIUM FROM MILK. Leon Singer and W. D. Armstrong (Univ. of Minnesota, Minneapolis). Nature 186, 484-5(1960) May 7.

Columns of pulverized modified bone were shown to be effective for the removal of Sr^{85} from milk. Analyses of milk before and after treatment are given, and the method used in bone preparation is discussed. (C.H.)

13559

MEDICAL REACTORS. A REVIEW OF U. S. PROGRAMME. Nuclear Eng. 5, 205-9(1960) May.

A survey of the medical and biological research program of the United States Atomic Energy Commission is presented. The various applications of irradiation and radioisotopes in medicine are briefly described, and the subject of medical research reactors is discussed. Such reactors presently operating in USA, e.g., at Los Angeles, MIT, Washington, Brookhaven, and Oak Ridge, are described. (D.L.C.)

13560

PHYSICAL STUDIES ON A SHORT-TREATMENT-DISTANCE CESIUM-137 TELETHERAPY UNIT. A. Cole, W. K. Sinclair, G. H. Fletcher, and G. C. Johnson (Texas Medical Center, Houston). Radiology 74, 731-42(1960) May.

Studies were made with a compact short-treatment-distance cesium-137 teletherapy unit. Measurements around the head indicated that the unit had more than adequate shielding for the present source; measurements also showed that a 2-foot wall of concrete would provide sufficient primary barrier protection to restricted areas. Output in air was 75 r/min at 22 cm SSD and was field-size dependent. Back-scatter ranged up to 7 per cent. A broad-beam half-value layer of 6.9 mm of lead was measured. The effects on initial depth dose of such factors as filter material, field size, SSD, type of collimation system, and magnetic field were examined. Depth dose in wax was measured for field sizes from 0 to 200 sq cm, at 15, 22, and 30 cm SSD. Isodose plots illustrated the poor beam-edge definition provided by a diaphragm type collimator with moderate skin separation and the good definition provided by a cone collimator extending to the skin surface. It was decided that a magnetically filtered open-sided cone of separate primary and secondary collimators at 20 cm SSD was to be preferred for the treatment of tumors lying within 3 cm of the skin surface. Initial clinical studies have shown significantly less skin reaction, with brass-filtered cesium-137 irradiations than with comparable 250-kevp x irradiations. (auth)

13561

IMMUNOLOGIC PROBLEMS IN TISSUE TRANSPLANTATION FOR RECOVERY FROM RADIATION INJURY. C. Congdon (Oak Ridge National Lab., Tenn.). 5p. of "XXI Congreso Internacional de Ciencias Fisiológicas, Fisiologia y Farmacologia, Buenos Aires, 9-15 de Agosto 1959."

The most successful approach to the problem of recovery from whole-body irradiation injury in mammals is bone marrow transplantation. Its value in the experimental animal is limited to the lower end of the supralethal dose range, indicating the need for more powerful ways to promote recovery of the injured intestinal mucosa or for new techniques for transplanting epithelial organ systems. Immunologic problems in foreign bone marrow transplantation are the major concern in developing a practical experiment that can be applied to human beings. (auth)

Biochemistry, Nutrition, and Toxicology

13562 LA-2329
Los Alamos Scientific Lab., N. Mex.
PUQFUA: AN IBM-704 FORTRAN CODE FOR DETERMINING PLUTONIUM BODY BURDEN FROM URINE ASSAYS. James N. P. Lawrence. July 1959. 33p. Contract W-7405-eng-36. OTS.

PUQFUA is an IBM-704 FORTRAN program, written primarily for Pu^{239}, which calculates from urinalyses the plutonium body burden in microcuries and the percent of the maximum permissible body burden. It is based on a set of power function elimination equations developed for the excretion of plutonium over a five-year period. Results with PUQFUA compare favorably with those of other methods. In general, it is easy to apply for a large number of individual samples, and the validation method is objective and requires no past experience with plutonium body burden calculations on the part of the evaluator. (auth)

13563
STUDIES ON THE CYTOTOXICITY OF CYSTEAMINE AND RELATED COMPOUNDS IN TISSUE CULTURE. Aage Juhl Therkelsen (Univ. of Aarhus, Denmark). Acta Pathol. Microbiol. Scand. 42, 201-15(1958). (In English)

The cytotoxicity of cysteamine and three closely related compounds was studied in tissue cultures of chick-heart fibroblasts by a modified hanging-drop technique. The pictures of intoxication produced by the various compounds are described. It was demonstrated that glutathione reduces the cytotoxicity of cysteamine, whereas it does not influence the cytotoxicity of S-methyl-cysteamine. A possible explanation of the cytotoxic effect is discussed. (auth)

13564
STUDIES ON THE PROTECTIVE ACTION OF CYSTEAMINE AND RELATED COMPOUNDS AGAINST NITROGEN MUSTARD (HN2) INJECTED INTO MICE. Aage Juhl Therkelsen, (Univ. of Aarhus, Denmark). Acta Radiol. 49, 49-65(1958) Jan. (In English)

Investigations into the protective action of cysteamine against nitrogen mustard (HN2) are described. A selective protection upon the bone marrow as compared with the small intestine and spleen was observed. The comparative protective action of related agents is discussed in detail and an explanation is put forward for the variation in the toxicity of these substances, as judged by their effect upon mice. (auth)

13565
COMBINED TREATMENT OF A TRANSPLANTABLE MOUSE TUMOUR WITH CYSTEAMINE (β-MERCAPTOETHYLAMINE) AND NITROGEN MUSTARD (HN2). A. J. Therkelsen (Univ. of Aarhus, Denmark). Biochem. Pharmacol 1, 245-57(1958).

The toxic effect of cysteamine was studied after repeated injections into AKA mice. In a series of experiments in which a lymphocytic neoplasm was transplanted into AKA mice it was shown: that cysteamine and nitrogen mustard (HN2) exert an additive effect on the size of the subcutaneously transplanted tumor but that this effect is probably due to the weight loss which occurs during the treatment of the animals; that cysteamine has no therapeutic effect on the tumor used; that cysteamine given 4 to 6 hr before HN2 does not affect the increased survival time produced by HN2; and that cysteamine given 15 to 20 min before HN2 does not reduce the increased survival time produced by HN2 but that a considerably greater increase in survival time can be obtained by a combination of the two drugs than when HN2 is given alone, since cysteamine seems to afford a certain protection against the lethal effect of HN2 without a simultaneous reduction in the tumor-inhibitory effect of the latter. It is therefore concluded that the protective effect of cysteamine against HN2 can scarcely be explained by an inactivation of the latter by its linkage to the SH group of cysteamine. Other possible explanations of the effect are discussed. (auth)

13566
ISOLATION AND INVESTIGATION OF INDUCED ASPOROGENIC MUTANTS. D. G. Lundgren and G. Beskid (Syracuse Univ., N. Y.). Can. J. Microbiol. 6, 135-51(1960).

A simple chemically defined medium was developed which supported good growth and sporulation of B. cereus var. lacticola. Normal growth and sporulation habits in the medium were determined employing an active growth-culture technique. Induced asporogenic mutants were isolated employing ultraviolet light as the mutagen. Mutants differed in their sporulation habits from the normal culture when grown at 37°C under the standardized conditions in a minimal synthetic medium. Three mutant cultures appeared to be temperature-sensitive mutants as regards sporulation, that is, in the minimal medium mutant cultures were able to sporulate when grown at 28°C but were non-sporulating at 37°C. Sporulation blocks were partially reversed when casein hydrolyzate and some low molecular weight protein building blocks were added to the synthetic medium. The pH changes of the medium during growth and sporulation of normal and mutant cultures were compared. (auth)

13567
THE EXCRETION OF DEOXYCYTIDINE WITH URINE FOLLOWING IRRADIATION. I. Paržizek, M. Arient, Z. Denstvir, and I. Škoda. Med. Radiol. 5, No. 3, 31-8 (1960) Mar. (In Russian)

The existing diagnostic modes of irradiation do not comply with the requirements of speed and specificity. A simple and sufficiently sensitive method is given for determining substances containing deoxyribose in the urine. It is excreted with urine when the doses of ionizing radiation are over 100 to 200 r. (auth)

Fallout and Ecology

13568 A/AC.82/G/L.306
Sweden. Försvarets Forskningsanstalt, Stockholm and Karolinska Mediko-Kirurgiska Institutet, Stockholm.
DOSAGE IMPLICATIONS BASED ON MICROSCOPIC DISTRIBUTION. R. Björnerstedt and A. Engström. Nov. 1959. 32p.

Presented at the Conference "Radioisotopes in the Biosphere," held in Minneapolis, Oct. 19-23, 1959.

The hazards from environmental strontium-90 are evaluated. Factors affecting the tissue distribution of strontium following both acute and chronic administration are discussed. Methods for calculating dose-rate and dose-damage relationships are discussed. (C.H.)

13569 A/AC.82/G/L.307
Sweden. Försvarets Forskningsanstalt, Stockholm.
A METHOD FOR DETERMINATION OF THE STRONTIUM DISTRIBUTION IN HUMAN BONE. R. Björnerstedt and S. Häggroth. Nov. 1959. 6p.

Methods are discussed for the use of autoradiography in studying levels of Sr^{90} in human bones. The importance is stressed of determining the distribution of Sr^{90} in the skeleton in evaluating the biological effects of Sr^{90} from fall-out. It is expected that evenness of distribution will vary with age and date of birth. A new technique of sample preparation is described which avoids disturbances from other activities than $Sr^{90} + Y^{90}$. (C.H.)

13570

THE BEHAVIOUR OF Sr-89, Cs-137 AND FISSION PRODUCT CONTAMINATION DURING THE BREWING OF PILSENER BEER. H. Bergh, H. Kringstad, and B. Ottar (Norwegian Defence Research Establishment, Norway and Brewing Research Lab., Oslo). Brygmesteren 16, 233-41 (1959).

Some tracer experiments with Sr^{89}, Cs^{137}, and fission products present during the brewing of pilsener beer are described. Only 1.0% of the radiostrontium added finally reached the beer. For radiocesium 70%, and for fission products as a whole, 12.5% of the radioactivity was found in the beer. Some figures are given for the Sr^{90} and Cs^{137} fall-out contamination in Norwegian beers. (auth)

13571

UPTAKE AND DISTRIBUTION OF STRONTIUM IN VEGETABLES AND CEREALS. R. B. Duckworth and J. Hawthorn (Royal Coll. of Science and Tech., Glasgow). J. Sci. Food Agr. 11, 218-25(1960) Apr.

Experiments are described in which a range of cereals, root crops, and Brassicas was grown in sand using culture solutions containing Sr^{89}. The distribution of the tracer in the mature plants and in the different parts of the cereal grains is reported and illustrated using autoradiography. The mode of uptake of fall-out radiostrontium by plants in the field is discussed, and the present results are interpreted in terms of the extent to which man's selection of particular parts of plants may affect the levels of radiostrontium in his own immediate diet. (auth)

13572

THE EMPLOYMENT OF ION-EXCHANGE RESINS FOR THE REMOVAL OF PLUTONIUM FROM THE GASTROINTESTINAL TRACT. Yu. A. Belyaev. Med. Radiol. 5, No. 3, 44-7(1960) Mar. (In Russian)

Experiments conducted on rats with $Pu(No_3)_4$ of Pu-citrate introduced perorally disclosed that ion-exchange resins reduce by several times the content of Pu in the organism of treated rats. Their efficacy decreases with the lengthening of the time lapse between the administration of plutonium and the introduction of ion-exchange resins. The latter is due to the rapidity of plutonium resorption from the gastrointestinal tract. (auth)

13573

ABSORPTION OF SHORT-LIVED RADIOACTIVITY BY SEA ORGANISMS. G. G. Polikarpov. Priroda 49, No. 1, 105-7(1960) Jan. (In Russian)

Analysis was made of P^{32} and Y^{91} uptake by various marine organisms. Results indicated that Ulva rigida and Mytilus galloprovincialis are strong P^{32} accumulators. All algae and sea weeds accumulate yttrium in about equal amounts. (R.V.J.)

13574

RADIOACTIVITY STORED UP BY ALGAE. A. D. Akamsin V. P. Parchevskii, and G. G. Polikarpov (Kovalevskii Sebastopol Biological Station). Priroda 49, No. 2, 95-6 (1960) Feb. (In Russian)

A fast radiometric method of measuring radioactivity uptake by marine organisms is described. (R.V.J.)

13575

BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY. NUMBER 19 [FOR] OCTOBER-DECEMBER, 1959. Tokyo, The Japan Meteorological Agency, 1960. 93p. (In English and Japanese)

Data are tabulated on the radioactivity in samples of rain water and dust collected at various stations throughout Japan during October, November, and December, 1959. (C.H.)

Radiation Effects on Living Tissues

13576 NADC-MA-5908

Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Penna.

PRELIMINARY STUDIES ON THE MECHANISM OF RADIATION DAMAGE TO OXIDATIVE PHOSPHORYLATION IN SPLEEN MITOCHONDRIA. Report No. 6. B. David Polis and Freeman W. Cope. July 9, 1959. 10p. Project No. NM-11-01-12.7.

Whole-body x irradiation of rats strongly inhibits oxidative phosphorylation of spleen mitochondria. The addition of serum albumin to the reaction mixture, to a great extent reverses this inhibition. The inference is drawn that x irradiation increases the permeability of spleen mitochondria, allowing the leakage of a heme protein, called mitochrome, which was recently isolated in this laboratory. The inhibitory effects of mitochrome on x irradiated mitochondria are counteracted by serum albumin in vitro, so that a partial recovery from the changes caused by irradiation is attained. The data further suggest the possibility of reversing the effects of x radiation on mitochondria by cofactor replacement, with the implication that resolution of the components involved might be of therapeutic value in irradiation sickness. (auth)

13577 NP-8644

Minnesota. Univ., Austin. Hormel Inst.

INVESTIGATION OF THE IDENTITY AND IMPORTANCE OF THE VOLATILE COMPOUNDS PRODUCED DURING IRRADIATION OF FATS. Report No. 8 (Final) [covering] Period December 27, 1956–October 26, 1958. W. O. Lundberg. 34p. Project No. 7-84-01-002. Contract DA-19-129-QM-834.

The volatile compounds present in irradiated hexadecane, octadecene, methyl oleate, methyl oleate-casein mixtures, and ground beef were studied. Methods for the separation, fractionation, isolation, and identification of these compounds were developed. Irradiation of hexadecane, octadecene, and methyl oleate in an atmosphere of oxygen produced mainly peroxides, acids, aldehydes, and typical pungent, rancid, oxidized odors. Unsaturation of the molecule or carboxylic groups are not required for the formation of undesirable compounds during irradiation of lipides. Similar compounds were found in irradiated methyl oleate-casein mixtures, but the odor of these irradiated mixtures was different from that of irradiated methyl oleate alone. The volatile carbonyl compounds from irradiated methyl oleate consisted mainly of saturated and unsaturated monocarbonyls with less than 9 carbon atoms and of α-dicarbonyls. A noncarbonyl fraction was tentatively identified as the methyl ester of a terminally epoxidized acid with 8 to 12 carbon atoms. Irradiation of ground beef increases the carbonyl content of the fat. The steam distillates of irradiated ground beef contain considerably more C_8 and C_3 monocarbonyls than the nonirradiated controls. The steam distillates also contained dicarbonyl compounds, some of which are very similar to diacetyl. The extracted fat from ground beef contained monocarbonyl compounds but no dicarbonyls. (auth)

13578 NP-8645
Michigan State Univ., East Lansing.
INVESTIGATION OF PHYSIOLOGICAL FACTORS WHICH CONTRIBUTE TO THE RADIORESISTANCE OF SPORES OF CLOSTRIDIUM BOTULINUM. Report No. 8 (Final) [for] Period May 9, 1958–September 8, 1959. Ralph N. Costilow. 22p. Project No. 7-84-01-002. Contract DA-19-129-QM-1177.

The radioresistance of spores of Clostridium botulinum was not affected by a variety of sporulation media or by the addition of sulfur-containing amino acids, thiamine, ammonium sulfate, or metallic ions to the sporulation medium. (C.H.)

13579 TID-5633
Worchester Foundation for Experimental Biology, Shrewsbury, Mass.
EFFECTS OF RADIOCOBALT IRRADIATION OF RABBIT GERM CELLS AND EMBRYOS. Annual Progress Report and Renewal Proposal. M. C. Chang. [1960]. 28p. Contract AT(30-1)-1934. OTS.

Progress is reported in studies on the effect of in vitro radiocobalt irradiation of rabbit ova on subsequent development in vivo with special reference to the irradiation of the maternal organism, the effects of whole-body irradiation on subsequent estrus, ovulation, and pregnancy in the rat, and light absorption of nucleic acids following irradiation of ejaculated and epididymal rabbit spermatozoa. (C.H.)

13580 USNRDL-TR-411
Naval Radiological Defense Lab., San Francisco.
THE USE OF IONIZING RADIATION AS A MOTIVATING STIMULUS. J. Garcia, D. J. Kimeldorf, and E. L. Hunt. Mar. 30, 1960. 36p.

A review was made of studies in which ionizing radiation was employed as the motivating stimulus to produce learned avoidance behavior in mammals. Aversion to food and water, aversion to a distinctive gustatory stimulus, and avoidance of the place of radiation exposure have been used to demonstrate this conditioning. The phenomenon has been found with cats and mice as well as with rats. Doses as low as 7.5 rad and rates of exposure which ranged from 0.04 r to 10.0 r per minute were effective in producing conditioning without alteration in the essential character of the learning. Conditioning has been obtained with fast neutrons as well as with gamma and x rays. Intervention by surgery (ophthalmectomy, adrenalectomy, hypophysectomy) failed to disrupt the formation of avoidance conditioning. With the use of partial-body exposures it was found that the abdominal region was relatively radiosensitive in the formation of learned avoidance behavior. The relative regional sensitivity parallels that found in physiologic studies of gastrointestinal dysfunction produced by radiation. The thesis is advanced that radiation stimulation by-passes the usual sensory channels and that the motivation state which results from exposure is produced by the organism's responses to radiation injury. (auth)

13581 JPRS-1758-N
EFFECTS OF SMALL DOSES OF IONIZING RADIATION ON THE BLOOD PICTURE IN RELATION TO OCCUPATIONAL HARMFULNESS. M. B. Golubitskaya. Translated from Med. Radiol. 1, No. 6, 6-13(1956). 14p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3304.

13582 JPRS-2255
CHANGES IN PERMEABILITY OF VASCULAR BARRIERS FOLLOWING THE ACTION OF IONIZING RADIATION ON THE ORGANISM. N. V. Butomo. Translated from Med. Radiol. 4, No. 10, 9-13(1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4241. (C.H.)

13583 JPRS-2306
CHARACTERISTICS OF THE COURSE OF COMBINED AFFECTIONS CAUSED BY THE ACTION OF IONIZING RADIATION AND BURN TRAUMA. A. L. Komendantova, Ye. A. Khrushcheva, K. V. Botsmanov, O. P. Kokorina, and O. A. Yuchenkova. Translated from Med. Radiol. 4, No. 10, 54-8 (1959). 9p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4266.

13584 JPRS-L-808-N
GENETIC EFFECTS OF SMALL DOSES OF IONIZING RADIATIONS. N. I. Shapiro. Translated from Med. Radiol. 4, No. 2, 67-77(1959). 26p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14429.

13585 JPRS-L-921-N
THE NATURE OF CHANGES IN THE ANTIGENIC STRUCTURE OF PROTEINS UNDER THE EFFECTS OF IONIZING RADIATIONS. L. A. Zilber and V. A. Artamonova. Translated from Med. Radiol. 4, No. 5, 3-6(1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15877.

13586
ALTERATION IN GLUCOSE TOLERANCE PRODUCED BY IRRADIATION OF THE PELVIS. Lilia Lopez Borja, John B. Graham, and J. E. Dowd (Roswell Park Memorial Inst., Buffalo). Acta Radiol. 53, 300-4(1960) Apr. (In English)

Cancer of the cervix patients receiving pelvic radiation exhibit an increased tolerance for glucose given orally and a diminished tolerance for glucose given intravenously. There is a return toward normal several months after the conclusion of radiotherapy. (auth)

13587
CHANGES IN MEMBRANE POTENTIALS, K CONTENT, AND FIBER STRUCTURE IN IRRADIATED FROG SARTORIUS MUSCLE. Edgar B. Darden, Jr. (Oak Ridge National Lab., Tenn.). Am. J. Physiol. 198, 709-14(1960) Apr.

Changes in membrane potential, K content, and fiber structure were studied in excised frog sartorius muscles that had received massive single doses (50 to 200 kr) of ionizing radiation. With muscle in normal Ringer's solution at 25°C, the median membrane potential declined and K leakage increased progressively, as measured at intervals, after exposure doses above ~100 kr; in K-rich Ringer's solution, decline was appreciably slower. In individual irradiated fibers, membrane potentials recorded at different points along a fiber tended to be nonuniform. When subsequent histologic alteration occurred, it often originated as a focal disorganization of structure in a region of minimum membrane potential. Visible pathologic changes resembled in part Zenker degeneration in intact muscle. It is suggested that decline in membrane potential, histologic changes, and increased K leakage are different expressions of the same basic radiation lesion. Radiation-induced changes were markedly retarded by posttreatment storage at 3°C. (auth)

13588
BIOELECTRIC RESPONSES IN SITU OF MAMMALIAN

NERVES EXPOSED TO X-RAYS. C. S. Bachofer and M. E. Gautereaux (Univ. of Notre Dame, Ind.). Am. J. Physiol. 198, 715-17(1960) Apr.

Irradiation of ventral caudal nerves of rat in vitro produces an increase in spike amplitude and in conduction velocity of the propagated impulse. In order to determine to what extent these results are due to the artificial environment in which the nerve was placed, a series of experiments was carried out in which the bioelectrical effects of x rays on the ventral caudal nerve in situ were investigated. Immediately upon x irradiation there was a considerable increase in spike amplitude and a somewhat lesser increase in conduction velocity. Following the increase there was a deterioration with ultimate block of conduction. At equal doses the in situ preparations were slightly more radiosensitive. There was a remarkable similarity in the responses of nerves irradiated in vitro and in situ. The effect cannot be attributed to such environmental factors as a change in temperature of the preparation or to alterations in the blood supply. The effect is apparently due to an altered condition of the nerve fiber itself, since the x rays do not act synergistically to produce the enhancement reported. (auth)

13589

THE EFFECT OF IONIZING RADIATION, ADRENALECTOMY AND CORTISONE TREATMENT ON THE INTESTINAL ABSORPTION OF AMINO ACIDS. O. A. Shishova (Inst. of Nutrition, Academy of Medical Sciences, Moscow). Biochemistry (U.S.S.R.) (English Translation) 24, 812-17 (1959) Sept.-Oct.

Protein assimilation, nitrogen balance, and the nitrogen and labile phosphorus content of the intestinal wall of rats were virtually unaffected by x irradiation in doses of 400 r. When irradiation doses reached 500 to 600 r, the rate of amino acid absorption in the gut decreased. The stimulating effect of ATP, phosphate, and Mg-ion added with the mixture was less pronounced in irradiated animals than in normal controls. Adrenalectomy was found to decrease considerably the rate of amino acid absorption in the intestine. On the other hand, the intestinal absorption of amino acid mixtures and of histidine in animals treated with excess cortisone was considerably higher than in controls. Labile phosphorus concentration in the intestinal wall and in the lumen contents was also decreased in the irradiated animals compared to controls; it was also increased with cortisone treatment. The decreased ability of adrenalectomized and x-irradiated rats to absorb amino acid mixtures and pure histidine from the intestine indicates that the intestinal absorption of amino acids is coupled with their phosphorylation. (auth)

13590

THE EFFECT OF IONIZING RADIATION ON THE OXIDATIVE PROCESSES IN TEA AND TOBACCO LEAVES. O. A. Virovets and A. G. Pasynskii (Bakh Inst. of Biochemistry, Academy of Sciences, Moscow). Biochemistry (U.S.S.R.) (English Translation) 24, 848-53(1959) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2317.

13591

THE MECHANISM OF THE FORMATION OF MICRONECROTIC FOCI IN THE BONE MARROW OF ANIMALS ACTED ON BY PENETRATING RADIATION INVESTIGATED BY FLUORESCENCE AND ULTRA-VIOLET MICROSCOPY. M. P. Bukhman and T. M. Kondrat'eva (Central Scientific Research Inst. of Medical Radiology, Leningrad). Biophysics (U.S.S.R.) (English Translation) 4, No. 4, 77-84(1959).

In the bone marrow of irradiated animals micronecrotic foci are easily revealed by the methods both of fluorescence and of ultraviolet microscopy. In the fluorescence microscope micronecroses stand out against the general background of living cells with a continuous bright green fluorescence (when treated with acridine orange); in the ultraviolet microscope with stronger, more continuous absorption of ultraviolet light. Micronecrotic foci are rounded conglomerates of closely lying cells with a definite type of injury (exfoliation and collapse of nuclear substance), as if immersed in a homogeneous medium. They are never found in the control animals. The combined uses of fluorescence and ultraviolet microscopy made it possible to approach an understanding of the mechanism of the formation of micronecroses. As a result of the action of ionizing radiation on part of the cells, exfoliation and collapse of the nuclear substance occurs, with discharge from the cells of nucleic acids, and their combination modified both physically and chemically. This obviously leads to cohesion of cells with the same kind of injuries. Additional irradiation of the micronecroses by ultraviolet light results in their disintegration into separate cells. (auth)

13592

THE INFLUENCE OF WHOLE-BODY X-RAY IRRADIATION WITH FRACTIONATED DOSES ON THE CONDITIONED ACTIVITY OF DOGS. E. S. Meizerov (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 4, 85-97 (1959).

Following x irradiation with fractionated doses, serious disturbances of the higher nervous activity occur 3 to 4 months earlier than the appearance of marked external symptoms of radiation sickness, which confirms the high degree of sensitivity of the cortex to this form of irradiation. Whole-body x irradiation with fractionated doses, on reaching a total dose of 500 r, caused significant weakening of both the stimulating and the braking processes and a lowering of the functional capacity of the cells of the cortex. In all our tests during the most serious disturbances of the higher nervous activity unconditioned reflexes remained normal. In some cases with irradiated animals a phase of improvement of the higher nervous activity was observed. This improvement was not imaginary, as Nemenov suggested, but true, as was confirmed by special experiments. In the following phase the increase of conditioned reflexes was accompanied by a deterioration of the higher nervous activity. The phase of improvement in the higher nervous activity in irradiated animals, as also the occurrence in the pre-mortal period, occurred against a background of serious disturbances of the cortical function, as measured by isolated tests with normal conditioned reflexes; it is understood to be a manifestation of a compensatory process. (auth)

13593

EFFECT OF X-RADIATION ON THE CELLULOSE CONTENTS OF WHEAT PLANTS. I. M. Vasil'ev and N. D. Rybalka (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 4, 155-6(1959).

Examination of the experimental results leads to the conclusion that x irradiation of wheat plants, even with such large doses as 50 or 100 kr, does not affect their cellulose content. There is no difference, in this respect, between irradiated and nonirradiated plants. (auth)

13594

IMMUNOLOGIC MECHANISMS IN HEAVILY IRRADIATED MICE TREATED WITH BONE MARROW. J. W. Hollingsworth (Veterans Administration Hospital, West Haven, Conn. and Yale Univ., New Haven). Blood 14, 548-57(1959) May.

Humoral antibody production was studied in severely irradiated mice treated with isologous (same strain) or homologous (different strain) bone marrow. The two methods of study involved functional end points of humoral antibody production as evidenced by in vivo lysis of rat erythrocytes or by regression of mouse leukosis E.L. 4 in histoincompatible mouse recipients. Humoral antibody production was lost after irradiation and isologous marrow treatment, but recovered partially in two weeks and almost completely in four weeks. Established immunity was not abruptly terminated after irradiation and treatment with either isologous or homologous marrow, although there was premature loss of immunity to rat erythrocytes by the irradiated, isologous marrow-treated mouse. Permanent immunity could not be transferred by isologous marrow or spleen from immunized donors to irradiated recipients. Treatment of mice histoincompatible to E.L. 4 leukosis with histocompatible donor bone marrow failed to establish rejection of the tumor. These studies support the concept that humoral antibody production in irradiated, marrow-treated mice remains a function of the host rather than of the transplanted tissues. These studies failed to clarify the conflicting evidence concerning the mechanism of the late illness that occurs after treatment of the irradiated mouse with bone marrow from a different strain or species. (auth)

13595

AUTOGRAFTS OF BONE MARROW IN DOGS AFTER LETHAL TOTAL-BODY RADIATION. John A. Mannick, Harry L. Lochte, Jr., Charles A. Ashley, E. Donnall Thomas, and Joseph W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). Blood 15, 255-66(1960) Feb.

Four beagles were exposed to supralethal total-body irradiation from a 250 kv x-ray therapy machine. Four were exposed to similar irradiation from a cobalt-60 teletherapy unit. Dosages administered ranged from 600 to 1500 r, calculated as air dose at theoretical midbody line. After irradiation each dog was given an intravenous infusion of 1.4 to 3.7 billion cells of his own bone marrow. This sample of autologous marrow was aspirated through a surgical window in the femur immediately prior to the animal's irradiation and was stored in plasma and tissue culture fluid at 4 C while awaiting use. All dogs survived the acute radiation injury. There were two late deaths, one from intercurrent infection and one from small bowel obstruction. The six surviving dogs are in apparent good health 5 months to 10 months after irradiation. Control dogs in this laboratory have a 100 percent 15-day mortality after air dose of 600 r total-body irradiation. A comparison with a previous series of dogs grafted with homologous marrow shows that autologous marrow induces a recovery after lethal irradiation that is superior to the recovery induced by homologous marrow. The superior results observed after autologous marrow appear attributable to a rapid postirradiation recovery of lymphoid tissue as well as bone marrow. Circulating lymphocytes reappear, lymph nodes regain normal histologic appearance, and the serum gamma globulin pattern returns to normal. These latter events do not occur promptly after infusions of homologous marrow. (auth)

13596

IN VITRO AND IN VIVO ASSESSMENT OF THE VIABILITY OF DOG MARROW AFTER STORAGE. John A. Mannick, Harry L. Lochte, Jr., E. Donnall Thomas, and Joseph W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). Blood 15, 517-24(1960) Apr.

Assessment was made of the ability of dog marrow cells to survive storage at 4°C and at −79°C. Survival has been assessed in vitro by measurements of rates of DNA synthesis and in vivo by ability to restore marrow functions in lethally irradiated recipients. Dog bone marrow cells synthesize DNA in vitro at values 30 to 80% of normal after storage for 24 hours at 4°C. DNA synthesis is reduced to very low levels by storage for 96 hours at 4°C. Eight lethally irradiated beagle dogs (600 to 1500 r) survived acute irradiation effects and returned to normal health after receiving intravenous infusions of autologous bone marrow that had been stored at 4°C for 24 hours or less. One dog, similarly irradiated, failed to survive when given marrow stored for 96 hours at 4°C. A tenth dog did survive when given an exceptionally large quantity of marrow stored for 96 hours at 4°C. Dog marrow cells synthesize DNA in vitro at values 40 to 50% of normal in samples stored at −79°C in 15% glycerol for periods up to 17 days. Five lethally irradiated beagle dogs (1000 to 1500 r) survived acute irradiation effects and returned to normal health after receiving intravenous infusions of autologous marrow that had been stored at −79°C in 15% glycerol. One other dog, similarly irradiated and treated, regained marrow function but died of hepatitis. Two other irradiated dogs similarly treated did not regain marrow function and died. These two had received exceptionally small infusions of marrow cells. The observations demonstrate that dog marrow can be preserved satisfactorily at 4°C for 24 hours and in glycerol at −79°C for longer periods. The capacity of the stored marrow to synthesize DNA in vitro has correlated well with its ability to induce recovery in lethally irradiated autologous recipients. DNA synthesis in vitro appears to be a useful index of the ability of marrow cells to proliferate in vivo. (auth)

13597

INDIRECT EFFECT OF X-RADIATION ON THE RESPIRATORY METABOLISM OF EHRLICH ASCITES TUMOUR CELLS AND MITOCHONDRIA. M. H. Silk, I. J. C. Macintosh, A. D. A. Cooke, F. Gilowey, and A. O. Hawtrey (Liesbeek Cancer Research Clinic, Cape Town, South Africa). Brit. J. Cancer 13, 757-72(1959) Dec.

Various proteinaceous and nonproteinaceous physiological media were incubated 3 hours at 37°C with mouse antero-lateral abdominal wall tissue without radiation and with 1000 roentgen x radiation of the medium plus tissue prior to incubation. The respiratory and glycolytic metabolism of Ehrlich ascites cells and mitochondria was then compared in corresponding batches of media prepared with and without radiation. In some experiments oxidizable substrates were added to the media, while in others substrates liberated from the mouse abdominal wall tissue served to maintain respiration of the added ascites cells or mitochondria. With bicarbonate buffering, intact ascites cells showed lower aerobic glycolysis and markedly elevated oxygen uptake in the x-irradiated medium. With phosphate buffering the opposite effect was observed. Both intact ascites cells and mitochondria showed lower oxygen uptake in the x-irradiated medium. Mitochondria showed lower P/O ratios in the x-irradiated medium than in the corresponding non-irradiated control. Since neither the cells nor the mitochondria were directly radiated, the results demonstrate an indirect effect of x radiation on respiratory metabolism. The effect operates via the environmental medium irradiated in contact with a tissue selected to represent the normal tumor-bed and stroma of the Ehrlich tumor. The indirect effect does not seem due to radiolysis of the environmental medium itself, nor do organic hydroperoxides appear to be responsible. It is suggested that metabolic products from the irradiated tissue are liberated into the medium, and that these influence the respiration rate of added Ehrlich ascites cells and mitochondria. (auth)

13598

DNA CONTENT OF HUMAN TUMOURS: CHANGE IN UTERINE TUMOURS DURING RADIOTHERAPY AND THEIR RESPONSE TO TREATMENT. B. M. Richards and N. B. Atkin (King's Coll., London, Mount Vernon Hospital, Northwood, Middx., Eng. and Radium Institute, Northwood, Middx., Eng.). Brit. J. Cancer 13, 788-800(1959) Dec.

Measurements were made of the DNA content of cells from 29 human uterine tumors before, during, and after treatment by intracavitary radium or radio-cobalt. Six cases showed only slight changes in the pattern of DNA values at 3 to 7 days after the first treatment. Twenty cases showed the typical effect of irradiation, as seen at 7 or 14 days after the first treatment. There was an accumulation of cells having large amounts of DNA, which usually were multiples of the basic DNA value. The remaining cases presented certain unusual features. The changes that were observed are briefly discussed in relation to the effect of ionizing radiations on DNA synthesis and the mitotic process. While the typical response, with the appearance of cells having high DNA values, was seen in tumors which responded well to radiotherapy, 2 tumors which responded poorly were characterized by the appearance of a new modal DNA value in the triploid region. These 2 tumors, which histologically were adenoacanthomata, were also characterized by an unusual pattern of DNA values before treatment. The possibility that changes in the DNA content of cells during the early stages of radiotherapy, or perhaps the pattern of DNA values found before treatment, might form the basis of an objective test of radiosensitivity is discussed. (auth)

13599

A CHANGE IN A TRANSPLANTABLE ANAPLASTIC CARCINOMA BY PASSAGE THROUGH X-RADIATED F MICE. Warren Zahler (Roswell Park Memorial Inst., Springville, N. Y.). Cancer Research 20, 420-4(1960) May.

Mice of the F strain, normally resistant to pBr tumor, were irradiated with 350, 400, or 500 r and found to permit growth of the pBr tumor for 5 to 30 days. The tumor has been carried through more than 35 transplant generations. When nonirradiated F mice were challenged with the pBr tumor from irradiated mice, a 30.6 per cent transitory take resulted. When nonirradiated pBr mice were challenged with the same tumor, an 87.4 per cent take resulted. In genetic tests, a 30 per cent take was recorded in F_1(pBr × F) and a 2.8 per cent take in backcross generation (F_1[pBr × F] backcrossed to F). The data presented indicate that the tumor requires four genes for progressive growth. (auth)

13600

EFFECT OF TOTAL-BODY IRRADIATION ON THE TRANSPLANTABILITY OF MOUSE LEUKEMIAS. Joseph H. Burchenal, Herbert F. Oettgen, Ezequiel A. D. Holmberg, Sandra C. Hemphill, and Jeré Anne Reppert (Sloan-Kettering Inst. for Cancer Research, New York and Cornell Univ., Medical Coll., New York). Cancer Research 20, 425-30(1960) May.

Mice with advanced transplanted leukemia were given a single dose of total-body radiation, and leukemia cells from spleen, ascitic fluid, or subcutaneous tumors were transplanted 2 or 24 hours later into susceptible mice. The dose of radiation to donor animals sufficient to reduce the takes in suitable recipients to less than 50 per cent was from 2000 to 2500 r in leukemia B82T, 3500 r in P329 and B82, 3500 to 4000 r in L1210 and P1081, and over 5000 r in leukemias P388 and P815. It is obviously difficult to extrapolate between transplanted mouse leukemia and spontaneous human leukemia given irradiation by different technics, but these data suggest that it would be difficult to sterilize the cells of advanced human leukemia by levels of total-body irradiation, the toxic effects of which can be protected against by injection of human bone marrow. (auth)

13601

DETECTION OF ANTIGENIC DIFFERENCES IN ISOLOGOUS HOST-TUMOR SYSTEMS BY PRETREATMENT WITH HEAVILY IRRADIATED TUMOR CELLS. László Révész (Karolinska Institutet Medical School, Stockholm). Cancer Research 20, 443-51(1960) May.

It was confirmed that antigenic differences exist between methylcholanthrene-induced sarcomas of recent origin and their isologous hosts. No similar differences were demonstrable with spontaneous carcinomas and lymphomas of recent origin, while long-transplanted lines could provoke incompatibility reactions, probably due to genetic deviations between host and tumor in the course of time. (auth)

13602

THE GENETIC EFFECT OF ATOMIC RADIATIONS. Paul de Bellefeuille (Univ. of Ottawa). Compt. rend. 250, 2459-61(1960) Mar. 28. (In French)

The data gathered by the American Commission of Inquiry on the genetic effects of the atomic explosions on the populations of Hiroshima and Nagasaki are reexamined to discover a possible dysgenic effect from the irradiation of the father only or the mother only. The tabulation shows an adverse effect with respect to the sex of the child and to the number of stillbirths for the case of the irradiation of the mother and for the case of the irradiation of the father an adverse effect for the number of early infant mortalities. The probability of a dysgenic effect is indicated. (J.S.R.)

13603

EARLY CYTOLOGICAL CHANGES OF THE LYMPHOCYTIC AND MYELOID TISSUES OF THE SPLEEN OF THE MOUSE FOLLOWING IRRADIATION. M. Hill and M. Prasliska. Českoslov. biol. 6, 6-15(1957). (Translated from Referat. Zhur. Biol. No. 19, 1958, abstract No. 89366).

Within 1 to 30 hours following a single general irradiation of mice with 550 r, a series of degenerative changes was observed: fragmentation of the lymphocytes in the follicules and of the erythroblasts in the red pulp, kariorrhexis of the eosinophiles and extracellular phagocytosis of cellular fragments, and also regenerative processes. Among the animals irradiated with a similar dose, two groups were noted, in which the processes of fragmentation of the lymphocytes and of regeneration occurred at various intervals in the course of the first 30 hours. It is the opinion of the author that the development of the cytological shifts in the spleen depends upon the neurohormonal regulation of the organism.

13604

HISTOLOGICAL CHANGES IN THE KIDNEYS OF RABBITS FOLLOWING ROENTGEN IRRADIATION. J. Svejda and J. Kotas. Čzeskoslov. rentgenol. 12, No. 1, 1-6(1958). (Translated from Referat. Zhur. Biol. No. 19, 1958, abstract No. 89380).

The kidneys were irradiated in 8 rabbits (in 4 of them following left-sided nephrectomy) with increasing doses (150, 200, and 300 r) during the course of 3 months. The total deep dose was 5,000 r. In a second experiment one was irradiated in the course of 51 days with 200 or 300 r with a total deep dose of 7,000 r. The rabbits were killed within 7 months following irradiation. In all the animals, changes of the medium and small blood vessels were noted; the walls were thickened, hyalinized. The fibrous structure of the elastic membrane was disordered, and tears of the endothelium were visible in the narrow lumen of the blood vessels. Fibrosis of the parenchyma and shrinking of the kidneys were considered by the authors as a secondary manifestation.

13605

INDUCED RADIATION SENSITIVITY WITH FOUR RADIATION PROTECTIVE CHEMICALS. Janice Frady and J. B. Clark (Univ. of Oklahoma, Norman). Experientia 16, 150-1(1960). (In English)

The effects of glycine, pyruvic acid, sodium hydrosulfite, and phenol on the radiosensitivity of N. corallina, S. aureus, and E. coli were studied. The protective effect of the four chemicals on E. coli was confirmed for both x and ultraviolet radiation. Opposite results were obtained for S. aureus and N. corallina. Some discussion of the discrepancy between these and other results is given. (T.R.H.)

13606

THE INDUCTION OF RECESSIVE LETHALS IN DROSOPHILA OOCYTES. D. R. Parker (Univ. of California, Riverside). Genetics 45, 135-8(1960) Feb.

Recessive lethal induction by x irradiation of stages 7 and 14 of primary oocytes of Drosophila melanogaster was studied. Stage 14 gives about a twofold increase in lethals over stage 7. There is evidence for the occurrence of some two-hit lethals. Speculation is made on possible relations between sensitivity changes, breakage and rejoining, and recessive lethals. (auth)

13607

X-RAY IRRADIATION OF COCCIDIOIDES IMMITIS ARTHROSPORES: SURVIVAL CURVES AND AVIRULENT MUTANTS ISOLATED. J. M. Foley, R. J. Berman and C. E. Smith (Univ. of California, Berkeley). J. Bacteriol. 79, 480-7(1960) Apr.

X ray survival curves were obtained for arthrospores of Coccidioides immitis, using suspensions which were shown by nuclear stains to contain uninucleate and binucleate spores in a ratio of 1 : 1. The curves are sigmoid in shape and the LD$_{50}$ is approximately 14 kiloroentgens. Two auxotrophic avirulent mutants were isolated from among the survivors of 80 to 100 kiloroentgens of irradiation. The characteristics of these mutants are described. (auth)

13608

QUANTITATIVE CHANGES IN THE WHITE AND RED PULP OF THE SPLEEN DURING HEMOLYSIN FORMATION IN X-IRRADIATED AND NONIRRADIATED RABBITS. Dieter H. Süssdorf (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). J. Infectious Diseases 105, 238-52 (1959) Nov.-Dec.

Three series of rabbits received 500 r to the total body, to the body with the appendix shielded, and to the body with the spleen shielded. One day later, these animals were injected intravenously with a single dose of sheep erythrocytes. A fourth series of rabbits was not irradiated and received only antigen. At specified intervals after treatment, groups of 3 to 4 rabbits were sacrificed, and the amount of splenic white and red pulp in these animals was determined by planimetric measurement of microprojected spleen sections. Results are reported and discussed. (C.H.)

13609

THE ACTION OF RADIOACTIVE RUTHENIUM, STRONTIUM AND CESIUM UPON THE CONDITIONED REFLEX ACTIVITY OF WHITE RATS. L. N. Burykina. Materialy Toksikol. Radioaktiv. Veshchetv., 1957, 76-101. (Translated from Referat. Zhur. Biol. No. 19, 1958, abstract No. 89387).

The conditioned reflex activity was investigated by the alimentary-motor method. The sound of a metronome and white light were used as positive stimuli, blue light as a differentiating stimulus. The latent periods of the alimentary motor reflex were registered; the speed of the motor reaction (time required to reach the feeding rack), the differentiation, and the force relations were noted.

13610

CERTAIN FEATURES PECULIAR TO THE DEVELOPMENT OF RADIATION AFFECTION IN DOGS IN CHRONIC ACTION OF Sr^{90}. E. N. Klímova and O. G. Alekseeva. Med. Radiol. 5, No 3, 3-7(1960) Mar. (In Russian)

In view of the absence of pertinent literature, the influence of Sr^{90} on the conditioned reflex activity, immunological reactivity, and peripheral blood was studied. Experiments were staged on 4 dogs with different types of nervous systems. The investigations divulged that at the early stages there occurs a disturbance of higher nervous activity, then an inhibition of the phagocytic reaction, followed by a change of the peripheral blood and formation of lysozyme by the salivary glands. After Sr^{90} administration is stopped there is observed a partial restoration of the higher nervous activity and a temporary restoration of hematopoiesis. The immunological reactivity does not normalize. (auth)

13611

HEMATOPOIESIS IN THE PROGENY OF RATS SUBJECT TO THE ACTION OF Sr^{90}. T. A. Ivanova. Med. Radiol. 5, No. 3, 8-13(1960) Mar. (In Russian)

In the progeny of rats subjected to single intraperitoneal introduction of Sr^{90} (0.4 mc/gm), there is observed in the first months of life a large quantity of lymphoreticular cells and instability of granulopoiesis, later—neutrophilic leukocytosis associated with hyperplasia of the leukoblastic section in the bone marrow. Subsequent introduction of Sr^{90} to the experimental and control progeny provokes considerable changes in the peripheral blood and hematopoietic organs; these changes are more marked and manifest themselves earlier in the experimental progeny. After the administration of Sr^{90} to the experimental progeny subsequent pregnancy and labor produces a more profound and prolonged anemia and eukopenia than in the control animals. (auth)

13612

THE MORPHOLOGY OF BONE TUMORS DEVELOPING UNDER THE INFLUENCE OF PENETRATING RADIATION. B. M. Nikitin (Inst. of Experimental and Clinical Oncology, Academy of Medical Sciences, USSR). Med. Radiol. 5, No. 3, 13-18(1960) Mar. (In Russian)

In rats subjected to intraperitoneal administration of Sr^{89} (1 mc/gm body weight), changes appear in the bone tissue, which in 40% of cases transform into sarcomas. At first there is seen a disturbance of ossification, an intensified resolution of the bone substance and development of cellulofibrous tissue. After 30 days these manifestations progress. From the 120th to 170th day there are observed in individual instances reparative processes while in other—atypical structures appear. The period from the 170th to 200th day could be called presarcomatous, inasmuch as during this time the changes noted could be attributed to presarcomas. Following 200 days formed sarcomas are revealed. It is of interest to note that in the bones where no sarcomas developed the reparative processes never reach the complete restoration of normal bone structure. (auth)

13613

PULMONARY CHANGES IN RADIATION THERAPY OF CANCER OF THE ESOPHAGUS (CLINICO-ROENTGENOLOGICAL OBSERVATIONS). T. A. Tretyakova (State Scientific-Research Roentgen-Radiology Inst. of Health Ministry, RSFSR). Med. Radiol. 5, No. 3, 19-23(1960) Mar. (In Russian)

Observations are presented on 161 patients with cancer of the esophagus who were treated by static and mobile modes of roentgen therapy. Radiation changes in the lungs, typical for the so-called pleuropulmonitis, developed in the majority of patients during or after the irradiation. When static methods of irradiation were employed pleuropulmonitis developed in 75% of cases, whereas in the mobile mode of irradiation it was encountered in 51%, with a considerably milder course. Two phases of pleuropulmonitis are distinguished: acute-infiltrative which, according to our data, is manifested by three forms, and chronic-fibrous which produces pneumosclerosis and pleural changes. The clinical symptoms usually appear earlier than the roentgenological changes. Pleuropulmonitis could develop within 5 to 6 months after cessation of irradiation. Hence, a meticulous dynamic roentgenological investigation of thoracic organs is necessary before, during, and after the conduction of radiation therapy for the detection of this dangerous complication. (auth)

13614

ON LATE COMPLICATION FOLLOWING THE DIAGNOSTIC USE OF LONG-LIVED RADIOACTIVE SUBSTANCE (THORIUM). F. M. Lyass (Burdenko Scientific-Research Inst. of Neurosurger, Academy of Medical Sciences, USSR). Med. Radiol. 5, No. 3, 23-6(1960) Mar. (In Russian)

Four cases are described of late complications following unsuccessful cerebral angiography with penetration of thorium into the soft tissues of the neck. A count was made of the energy consumed from thorium radiation and products of its decay. The cicatrical process which developed in the patients examined is associated with the action of radiant energy. (auth)

13615

THE EFFECT OF RADIATION ON VITAMIN B_1 METABOLISM. Iori Uzno. Med. Radiol. 5, No. 3, 27-31(1960) Mar. (In Russian)

Investigations are presented of the influence of radiation on the blood level of vitamin B_1, and changes of vitamin B_1 excretion in urine. (auth)

13616

THE EXCRETION OF DEOXYCYTIDINE FROM THE ORGANISM IN DIFFERENT CONDITIONS OF IRRADIATION. Z. I. Zhulanova and E. F. Romantsev. Med. Radiol. 5, No. 3, 39-43(1960) Mar. (In Russian)

Studies are presented of the influence of high doses of roentgen and gamma irradiation on the excretion of dishe-positive compounds with urine in white rats. Upon irradiation on a roentgen apparatus with dose-capacity of 130 r/sec there was observed a sharp rise in deoxycytidine excretion with urine during the first 24 hours. This rise was proportional to the total dose of irradiation within the limits of 390 to 910 r. A further increase of the total dose up to 1,300 r did not elevate the deoxycytidine content in the urine. Upon irradiation on a gamma apparatus the maximal deoxycytidine excretion with urine was seen in the absolute minimum lethal dose (800 r). With a dose of 5,000 r there was a tendency towards a rise of deoxycytidine whereas with 20,000 r there was a tendency towards a decrease. The radiochemical reaction output was calculated. (auth)

13617

THE INFLUENCE OF X-RAY IRRADIATION UPON THE REACTIVITY OF ANIMALS DURING STROPHANTHIN ADMINISTRATION. A. V. Lazovskaya. Med. Radiol. 5, No. 3, 71-2(1960) Mar. (In Russian)

The sensitivity of heart glucose levels to strophanthin administered during acute and sub-acute radiation injuries, induced by x ray of 800 and 300 r, respectively, was studied in 600, 17 to 20 g white mice. Reactions to strophanthin following the exposure is of phase character, depending on the variations of strophanthin effects on heart action (depression of heart muscle sensitivity). (R.V.J.)

13618

ON THE CHANGE OF DOG'S GASTRIC REACTIVITY IN MULTIPLE TOTAL IRRADIATION. K. A. Grineva. Med. Radiol. 5, No. 3, 72(1960) Mar. (In Russian)

X-radiation effects on digestive tract functions were studied with 12 dogs following multiple exposures to doses of 12.5 to 25 r, with total dosage for 2 to 2½ years of 100 to 200 r. (R.V.J.)

13619

SOME DATA ON THE MECHANISM OF RADIATION EFFECT "PRESERVATION" IN FROG'S CORNEAL EPITHELIUM DURING HIBERNATION. I. B. Bychkovskaya. Med. Radiol. 5, No. 3, 73(1960) Mar. (In Russian)

The oxygen-radiation effects on the conservation of radiation injuries during hibernation were studied in frogs exposed to 900 r in a nitrogen atmosphere. Preliminary data indicate morphological changes in the epithelium begin developing after the awakening. Moreover, the radiation injuries are not altered during hibernation but are slowed down, confirming the existence of a radiation conservation mechanism. Experimental studies of protective effects of hypoxia show different morphological changes in cornea epithelium during hibernation and after awakening. Administration of hypoxia during irradiation of hibernating animals was not effective while hypoxia administered in active animals at the moment of exposure showed positive results, also confirming the protective effects of hypoxia during the initial stages of radiation injury. (R.V.J.)

13620

BLOOD CHANGES IN THE ULTRAVIOLET SPECTRUM DURING RADIATION SICKNESS. K. S. Kasyakov. Med. Radiol. 5, No. 3, 74-5(1960) Mar. (In Russian)

Data are presented on an ultraviolet (wave length 2810 and 2950 A) spectrophotometric method of radiation injuries diagnosis by determining the variations in whole blood. (R.V.J.)

13621

A CONNEXION BETWEEN S—S BOND BREAKAGE AND INACTIVATION BY RADIATION OF A DRY ENZYME. Dilip K. Ray, Franklin Hutchinson, and H. J. Morowitz (Yale Univ., New Haven). Nature 186, 312-13(1960) Apr. 23.

Results are reported from a study of the inactivation of a dry enzyme by ionizing radiation. Factors affecting radiosensitivity and the mechanism for the reaction are discussed. (C.H.)

13622

COMBINED APPLICATION OF HYDROGEN PEROXIDE AND IONIZING RAYS IN ANIMAL EXPERIMENTS. E. Fleischmann and H. Werkgartner (Univ. of Vienna and General Hospital, Vienna) and K. Karrer (Austrian Cancer Research Inst., Vienna). Nature 186, 324-5 (1960) Apr. 23.

The combination of x radiation and hydrogen peroxide did not inhibit the growth of Walker carcinosarcoma in rats. (C.H.)

13623

EFFECT OF OXYGEN ON THE RADIOSENSITIVITY OF BACTERIOPHAGE IN THE PRESENCE OF SULPHYDRYL COMPOUNDS. P. Howard-Flanders (Hammersmith Hospital, London). Nature 186, 485-7(1960) May 7.

Results of a study on the effect of oxygen on the radiosensitivity of bacteriophage in the presence of sulphydryl compounds indicate that the reason why oxygen is without effect on the x-ray inactivation of bacteriophage in protective suspensions lies in the absence of a suitable hydrogen donor such as a sulphydryl compound. A second factor is that some compounds may experience difficulty in penetrating into the compact structure of the phage head. The oxygen effect on the x-ray inactivation of the complex is presumably a reflection of the competition between molecular oxygen and intra-cellular hydrogen donors, such as sulphydryl compounds, for the radicals induced by radiation in the phage nucleic acid. (C.H.)

13624

YEAST RIBONUCLEIC ACID AND ITS NUCLEOTIDES AS RECOVERY FACTORS IN RATS RECEIVING AN ACUTE WHOLE-BODY DOSE OF X-RAYS. J. Maisin, P. Dumont, and A. Dunjic (Univ. of Louvain, Belg.). Nature 186, 487-8(1960) May 7.

Injections of yeast ribonucleic acid and its nucleotides were shown to reduce the mortality rate of rats exposed to doses of x radiation of 450 to 550 r. No protective effect was observed when injections were made before exposure. (C.H.)

13625

ALTERATION OF THE OXYGEN CONSUMPTION OF ISOLATED FROG MUSCLE AFTER X IRRADIATION. H. D. Bergeder and O. Hockwin (Universität, Bonn). Naturwissenschaften 47, 161(1960). (In German)

Isolated frog sartorius muscles were isolated and placed in Ringer solution saturated with oxygen at room temperature. The muscle sample was exposed to 75 and 300 kr. The oxygen consumption was measured after one hour. The results showed that 75 kr cause no change in the oxygen consumption, but 300 kr increase the consumption. The variation of the oxygen consumption begins at a radiation dose which also causes variations of the membrane potentials and the potassium content of the muscle. (J.S.R.)

13626

VERSATILE GAMMA FACILITIES AT THE UNIVERSITY OF FLORIDA. J. M. Duncan, R. K. Stock, J. A. Wethington, Jr., and H. J. Teas (Univ. of Florida, Gainesville). Nucleonics 18, No. 5, 126-9(1960) May.

Two relatively low cost Co^{60} irradiators are described. One is an 800-c source for irradiating small biological and chemical samples; the other is a 6,000-c open-air irradiator at the Agricultural Experiment Station for living materials. The design of the facility, safety devices, radiation levels, and application of the latter source are discussed. Dose rates for the 6-kc source vary from 2.8×10^5 r/hr at its center to 510 r/hr at 13 ft. The dose rate variation is 4.5×10^5 r/hr at the center of the center tube of the 800-c source to 5.7×10^4 r/hr for the 4-in.-diameter tube and decreases to ~50% at the upper and lower ends of the cobalt region. (B.O.G.)

13627

RADIATION CHIMERAS AND TISSUE TRANSPLANTATIONS. A. S. Shevelev. Priroda 49, No. 1, 20-5(1960) Jan. (In Russian)

A review is given on the antigen-antibody reactions in tissue transplantations and the new transplantation techniques and methods. (R.V.J.)

13628

STUDIES OF THE EFFECTS OF RADIATION ON ENZYMES. I. INACTIVATION OF CHYMOTRYPSIN AND CHYMOTRYPSINOGEN BY X-RAYS. L. A. Mounter (School of Medicine, Medical Coll. of Virginia, Richmond). Radiation Research 12, 487-94(1960) May.

The effect of x irradiation on the esterase and protease activities of chymotrypsin and chymotrypsinogen has been studied. The degree of inactivation has been compared to results obtained in a study of the ability of the irradiated samples to react with a specific inhibitor (DFP^{32}). The data suggest that radiation damage to enzyme molecules may result in impairment of catalytic efficiency without complete destruction of biological activity. These results are discussed. (auth)

13629

THE EFFECTS OF PRENATAL RADIATION ON POSTNATAL DEVELOPMENT IN RATS. R. L. Murphree and H. B. Pace (Univ. of Tennessee-Atomic Energy Commission Agricultural Research Lab., Oak Ridge, Tenn.). Radiation Research 12, 495-504(1960) May.

One hundred and twenty-four litters of rats were used in a study of the effects of prenatal irradiation (Co^{60}) on the viability and growth of the irradiated individuals. The neonatal death rate was significantly higher in litters exposed to 110 r on days 13 to 15 (27%, $P < 0.001$), on days 16 to 18 (13%, $P < 0.05$), 150 r on day 14 (98%, $P < 0.001$), and 220 r on days 12 to 16 (77%, $P < 0.001$) of gestation as compared to control litters (6%). The majority of postnatal deaths occurred by the seventh day. The viability was not affected in litters exposed to 150 or 220 r on day 20. The average weaning weights of all the irradiated groups were lower than the weight of the control group. When bred to normal males, no difference was found between control and prenatally irradiated females in per cent of fertile females, per cent of corpora lutea as represented by living fetuses, or fetal deaths. Ovulation was approximately 20% lower in the irradiated than in the control females. Mature body and testes weights of irradiated males were significantly lower than for control males ($P < 0.001$). The degree of retardation in testes weights was dependent on level of radiation and stage of gestation at time of irradiation. (auth)

13630

SURVIVAL OF TOTAL-BODY X-IRRADIATED MICE AFTER DELAYED INFUSIONS OF ISOLOGOUS BONE MARROW. Isaac Djerassi, Robert Woodruff, and Sidney Farber (Children's Medical Center and Harvard Medical School, Boston). Radiation Research 12, 505-9(1960) May.

Mice of the Swiss Webster, AKR/Jax, DBA_2, and ICR Swiss strains were protected from lethal doses of total-body x irradiation by single or repeated infusions of isologous bone marrow, given 4 to 7 days after exposure. (auth)

13631

IRRADIATION OF PROTEINS IN THE SOLID STATE. I. AGGREGATION AND DISORGANIZATION OF SECONDARY

STRUCTURE IN BOVINE SERUM ALBUMIN. P. Alexander, L. D. G. Hamilton, and K. A. Stacey (Inst. of Cancer Research, Royal Cancer Hospital, London). Radiation Research 12, 510-25(1960) May.

Solid bovine serum albumin was irradiated in the absence of oxygen with 2-Mev electrons. Changes in solubility, average molecular weight from light-scattering, sedimentation, and accessibility of disulfide groups were measured. Results are reported. (C.H.)

13632

IRRADIATION OF EGG ALBUMIN SOLUTIONS UNDER ANAEROBIC CONDITIONS. Roger J. Romani and A. L. Tappel (Univ. of California, Davis). Radiation Research 12, 526-31(1960) May.

Anaerobic egg albumin solutions have been irradiated, and analyses have been made of the nitrogen and sulfur loss from the protein and the formation of amides and carbonyls. The experimental data support the hypothesis that irradiation damage occurs via non—SH-dependent scission of the protein. (auth)

13633

ACUTE EFFECTS OF GAMMA RADIATION IN PRIMATES. Ralph G. Allen, Frank A. Brown, Loren C. Logie, David R. Rovner, Stephen G. Wilson, Jr., and Robert W. Zellmer (School of Aviation Medicine, Randolph AFB, Tex.). Radiation Research 12, 532-59(1960) May.

One hundred seven small primates were exposed in 16 groups to rapid delivery of Co^{60} γ-rays at doses of 400 to 40,000 r. Statistical evaluation of survival times, determination of the $LD_{50(30)}$ dose, clinical observations for a 30-day postirradiation period, and immediate postmortem examinations were performed. These three approaches to the investigation of the mechanism of radiation injury and death in the animal were evaluated. Each method separated the groups of animals into three distinct and corresponding categories. The clinical and pathological studies undertaken in this experiment provide further elucidation of the central nervous system, gastrointestinal, and hematopoietic types of radiation death. (auth)

13634

THE EFFECT OF WHOLE-BODY X-IRRADIATION ON AN ALPHA-GLOBULIN COMPONENT IN THE SERUM OF C_3H_f/HeHa MICE. E. S. Goranson, E. A. McCulloch, and E. A. Cinits (Univ. of Toronto and Ontario Cancer Inst.). Radiation Research 12, 560-6(1960) May.

Exposure of C_3H_f/HeHa strain mice to 950 rads of whole-body x irradiation was found to result in a striking enhancement after approximately 3 days of a nonlipid serum protein with an electrophoretic mobility characteristic of an α-globulin. This serum component has been shown to persist for a period of 10 months in irradiated mice protected by the injection of isologous bone marrow cells. The preliminary experiments reported suggest that the increase in the serum protein is not the consequence of nonspecific stress, nor can its appearance be entirely accounted for on the basis of cellular destruction in the period immediately after x irradiation. (auth)

13635

THE EFFECT OF X-IRRADIATION ON THE METABOLISM OF FOLIC ACID IN RAT ORGANS. K. Guggenheim, S. Halevy, A. Hochman, and M. Ben-Porath (Hebrew University-Hadassah Medical School, Jerusalem and Hadassah-Hebrew Univ. Hospital, Jerusalem). Radiation Research 12, 567-74(1960) May.

Folic acid (FA) and citrovorum factor (CF) in liver, kidneys, testes, thymus, and spleen of young rats were examined at various periods after x irradiation with 400 or 600 r. In spleen, the amounts of both FA and CF per gram of tissue were significantly diminished a few hours after irradiation, that of CF more than that of FA. These levels remained low for several days. In testes both FA and CF decreased from the tenth day on, the ratio between these two substances remaining unchanged. No marked change in concentration of either FA or CF occurred in thymus, liver, and kidneys. Local irradiation with 3000 r led to a considerable decrease in total amount of both FA and CF on the seventh day after irradiation. Aminopterin in a dose which markedly suppresses formation of CF from FA in the liver was without effect on FA and CF metabolism in spleen and thymus. These results do not support the assumption that the inhibition of formate incorporation and of DNA formation probably resulting from it (known to follow irradiation) is due to an interference with the metabolism of FA or the formation of CF. They may reflect changes in the cell population which take place in certain organs after irradiation. (auth)

13636

BIOELECTRIC ACTIVITY OF MAMMALIAN NERVES DURING X-IRRADIATION. C. S. Bachofer and M. E. Gautereaux (Univ. of Notre Dame, Ind.). Radiation Research 12, 575-86(1960) May.

The effect of x rays on certain bioelectric responses, in vitro, of the ventral caudal nerves of the rat was investigated. Electronic stimulation was used to determine the amplitude of the action potential and the conduction velocity of the propagated impulse, as well as the sensitivity of the nerve to stimulation. These values were determined before and during exposure to x rays. Considerable increases in spike amplitude were noted very soon after the beginning of x irradiation, with lesser increases for sensitivity and for conduction velocity. Each factor investigated reached its maximum and declined at a time quite independent of the time at which the other factors reached their maxima. This indicated independence of controlling mechanisms. The action of x rays was not synergistic in that the x ray beam could be cut off and the nerve would continue to respond for some time in its enhanced condition. The response, in fact, would continue to rise if it was in the rising phase when the x ray beam was cut off, and continue to fall if it was in the falling phase; the rise or fall proceeded at slower rates when the x ray beam was cut off. The rise did not continue indefinitely but reached a certain peak, after which the activity declined and ultimately fell to a level at which no response could be elicited. Stimulation at 50/sec and 100/sec caused a decline in the activity of the nerve. Once this decline was compensated for, the effect of x irradiation was evident: Stimulation at higher frequencies reduced considerably the enhancement of spike amplitude attributable to x rays, showed a somewhat lesser effect on enhancement of sensitivity, and showed no effect on enhancement of conduction velocity. Nerves under stimulation and x irradiation failed to respond as long as nerves under x irradiation alone. (auth)

13637

DNA SYNTHESIS IN IRRADIATED HAIR FOLLICLES OF THE MOUSE. S. M. Cattaneo, H. Quastler, and F. G. Sherman (Brookhaven National Lab., Upton, N. Y. and Brown Univ., Providence). Radiation Research 12, 587-93 (1960) May.

Hair follicles in mice were induced to produce hair by plucking and were then x irradiated with 200, 800, or 3000 rads. DNA synthesis in the proliferating matrix cells of irradiated hair follicles was studied at times from immediately after to 48 hours after irradiation, by the method of labeling with tritiated thymidine and autoradiography. Reduction of thymidine incorporation commences immediately after irradiation and amounts to about 50% within 30 minutes with the two higher doses, possibly also with 200 rads. This is an effect on cells in the process of synthesizing DNA at the time of irradiation. It is followed by a slow decline which may be of complex nature. Resumption of DNA synthesis occurs within 12 hours post-irradiation, even with the highest dose used, and considerably precedes resumption of mitotic activity. (auth)

13638

THYROID ABLATION WITH I^{131} IN EUTHYROID CARDIAC PATIENTS, WITH SPECIAL REFERENCE TO PREPARATION WITH ANTITHYROID DRUGS. J. P. Storaasli, E. L. Schoeniger, H. K. Hellerstein, and H. L. Friedell (Western Reserve Univ., Cleveland and University Hospitals of Cleveland). Radiology 74, 810-15(1960) May.

The use of antithyroid drugs in preparing the euthyroid cardiac patient for treatment with I^{131} has been stressed. These drugs increase the avidity of the thyroid gland for iodine so that smaller therapeutic doses can be given. They allow stored hormone to be released by the gland, thus minimizing the possibility of exacerbation of cardiac symptoms during maximum radiation effect, and afford a period of observation so that the stability of the cardiac impairment can be assessed prior to treatment. Two hundred seven euthyroid cardiac patients have been given ablating doses of radioactive iodine. Of these, 91 had angina pectoris and 116 had congestive failure as the predominant cardiac lesion. Seventy-six per cent of the patients with angina and fifty-six per cent of those in congestive failure derived worthwhile benefit commensurate with the production of hypothyroidism. This compares well with the results reported by others. (auth)

13639

PROBLEMS POSED FOR THE HEMATOLOGIST BY THE TREATMENT OF SUBJECTS ACCIDENTALLY IRRADIATED AT HIGH DOSAGE. Georges Mathé. Rev. hématol. 15, 3-9(1960) Jan.-Mar. (In French)

The hematological treatment of subjects accidentally exposed to high irradiation doses is reviewed. Except for extremely high doses the prime consideration is the determination of the dose received in which hematological examinations play a large role. Then serious hematological malfunctions require energetic symptomatic treatment. The isolation of the patient in order to maintain an aseptic environment is discussed. Finally, bone marrow transfusions are considered. (J.S.R.)

13640

RADIATION EFFECTS ON THE GROWTH AND PHOSPHORUS UPTAKE OF PLANTS GROWN IN SOIL TREATED WITH P^{32}. P. G. Marais and S. Fourie (Western Province Fruit Research Station, Stellenbosch, Union of S. Africa). S. African J. Agr. Sci. 2, 3-18(1959) Mar. (In English)

The effect of radiation from P^{32} on the growth and phosphorus uptake of rye and tomato plants was studied in soil culture. The plants were grown for 4, 7, and 12 weeks in two soils which were enriched with phosphate and treated with 0, 4, or 40 microcuries P^{32} per pot. The plant tops and roots were analyzed separately. The radiation effects observed were mainly stimulative, but did not vary directly with increasing levels of P^{32}. They depended on the species of plant employed, its age, and the soil in which it was grown. Furthermore, the P^{32} had a differential effect on the tops and roots, and on the dry weights and phosphorus contents of the plants. The magnitude of these effects was such that the influence of radiation cannot simply be ignored. It is concluded that in investigations of this type, experimental results must be accepted with reserve unless positive proof is afforded that radiation has had no significant effect. (auth)

13641

EFFECT OF REPEATED SMALL DOSES OF PENETRATING RADIATION ON THE RHEOBASE AND CHRONAXIE OF RABBIT MUSCLE. I. V. Maliukova (Public Health Medical Institute, Leningrad). Sechenov Physiol. J. (U.S.S.R.) (English Translation) 45, No. 11, 95-101(1959).

Repeated total irradiation with doses of 20 r produced change in the state of muscles in rabbits. Rheobase was reduced and chronaxie shortened during the period of the first six irradiation sessions. Opposite and more pronounced shifts, increase of muscle rheobase and prolongation of chronaxie, were seen from the seventh to the fifteenth session. Intensified movement was seen immediately after each of the first six irradiations, but 24 hr after each irradiation the animals' motor activity was reduced. All the changes observed in the excitability of the neuromuscular system were reversible, as rheobase and chronaxie regained their original values in the course of 2 weeks after the end of irradiation. Inverted relationships of the chronaxies and rheobases of the antagonist muscles were seen after a number of irradiations, this being evidence of the effect of the x rays on the central nervous system. The leucocyte count changes pointed to the development of a mild initial stage of radiation sickness in the irradiated animals. The prolongation of chronaxie and, more particularly, the increase of the muscle rheobase after repeated irradiation depended mainly on the effect of the x rays on the nerve centers, and not on the peripheral neuromuscular system. (auth)

13642

LATE INJURIES FROM RADIATION AND THEIR TREATMENT. Jürgen Lackner (Zentral-Rontgeninstitut, Bremen, Ger. and Städtische Krankenanstalt., Bremen, Ger.). Strahlentherapie 111, 546-54(1960). (In German)

A further report of 4 cases of late x-ray damage is given, including one case of x-ray-induced cancer, that was cured by radiotherapy and observed for 1 year. Three patients were treated by ultra sound in a water bath. The ulcerations were healed. The medico-legal aspects of radiation damage, which is always a combination damage, are discussed. The causes of the favorable effect of ultra sound are pointed out as well as the required experience for successful treatment. A definite treatment plan cannot be given. Physician and patient must have great endurance. The publication of radiation damages is important because their knowledge is important for better understanding of biological processes. (auth)

13643

THE RESTORATION OF HEMATOPOIESIS FOLLOWING LETHAL EXPOSURE TO RADIATION. Joseph W. Ferrebee and E. Donnall Thomas (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). Trans. Assoc. Am. Physicians 72, 284-93(1959).

The problem of restoring marrow function in men exposed to lethal radiation in the range 200 to 1000 roentgens is similar to the problem as it has been seen in other mammals. Isolation from infection and judicious use of antibiotics and fresh blood may keep the patient alive long enough for his own marrow to regenerate, if it has not been too badly damaged. This means in general doses below 400 roentgens. Infusion of cells of normal marrow will hasten restoration and are perhaps vital when exposure has been severe—doses above 400 roentgens. When the cells for infusion come from stored samples of the patient's own marrow or from an identical twin, the infusions may be made immediately after the radiation exposure, since in these instances there is no immunologic transplantation barrier to be surmounted and the sooner marrow function is restored, the better. When the donor is not an identical individual but an homologous volunteer, a better graft seems obtained by delaying infusion for a week or two while the barrier to transplantation deteriorates. When the foreign transplant is successful, delayed foreign marrow disease may occur: digestive upset, weight loss and infection. This to the extent it has been seen in man, appears clinically manageable. Finally, there is the observation that studies of marrow replacement in irradiated subjects can be carried out with benefit to the individuals studied. A few well-chosen patients with leukemia have had remissions of several months after radiation and marrow transplantation. (auth)

13644

THE GENERAL REACTION OF THE ORGANISM AND ELECTROENCEPHALOGRAPHIC CHANGES FOLLOWING IRRADIATION OF THE BRAIN WITH RADIOACTIVE COBALT. A. A. Zagadskaya, R. K. Arutyunyan, and K. A. Kyandaryan. Trudy 1-oĭ Zakavkaz. Konf. Med. Radiol., Tiflis, 1956, 132-7. (Translated from Referat. Zhur. Biol. No. 19, 1958, abstract No. 89383).

Radiation sickness was produced in rabbits by insertion of applicators with Co^{60} in the skin of the fronto-temporal area. During the first hours following irradiation the amplitude of the oscillations of the bio-potentials of the brain decreased and slower waves of duration of 0.30 to 0.35 sec appeared. The potentials became more frequent from the 3rd to the 7th day following irradiation. With the beginning of the second week a tendency to normalization of the EEG was observed as far as the re-establishment of the amplitude and reactivity was concerned, regardless of the manifestation of the general weakness associated with a markedly elevated excitability. The animals perished on the 7th to 13th day following irradiation. Men suffering from neoplasms of the skin of the upper part of the face and of the scalp were submitted to irradiation with Co^{60}. Patients with marked local skin reactions remained employable and practically normal during and after the period of irradiation. During the first days following irradiation, delta-waves appeared in the EEG of the patients, of 0.4 to 0.8 seconds duration, and the amplitude of the biopotentials decreased as well as the reactivity of the cerebral cortex. The EEG returned to normal within 10 or more days following irradiation.

13645

CHEMICAL PROPHYLAXIS IN RADIATION INJURIES. F. Yu. Rachinskiĭ, A. S. Mozzhukhin, N. M. Slavachevskaya, and L. I. Tank (Kirov Military-Medical Academy, USSR). Uspekhi Khim. 28, 1488-1522(1959) Dec. (In Russian)

A review is given of classified and generalized data on various types of chemical compounds and elements possessing potential protective effects against ionizing radiation. 269 references. (R.V.J.)

13646

THE EFFECT OF CATARACT GENES ON THE RADIATION SENSITIVITY OF THE LENS. U. Ehling (Oak Ridge National Lab., Tenn.) and E. Krokowski (Freien Universität, Berlin-Charlottenburg). Z. Naturforsch. 15b, 110-15(1960) Feb. (In German)

Experiments on rabbits show the importance of genes in the development of radiation damage to the lens. The two well recognized types of radiation damage to the lens, clouding and inhibition of growth, are dependent on age too. It was shown that the specific loci which reduce cell metabolism increase the radioresistance of the lens. The decrease in metabolism of the lens with age also increases its radioresistance. The consequences of these observations are discussed. (auth)

Radiation Sickness

13647 JPRS-2297

CERTAIN HISTOCHEMICAL STUDIES OF BLOOD CELLS IN ACUTE RADIATION SICKNESS. V. A. Gubin. Translated from Med. Radiol. 4, No. 10, 3-8(1959). 12p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4240. (C.H.)

13648 JPRS-L-804-N

PROPHYLAXIS OF RADIATION SICKNESS OF AN INTRAUTERINELY-IRRADIATED FETUS. A. P. Kiryushchenkov. Translated from Med. Radiol. 4, No. 2, 10-14 (1959). 7p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14181. (C.H.)

13649 JPRS-L-806-N

PATHOLOGICAL ANATOMY OF THE DEATH OF ANIMALS UNDER A 25-MEV BETATRON RAY. I. V. Toroptsev and N. V. Sokolova. Translated from Med. Radiol. 4, No. 2, 50-3(1959). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14187. (C.H.)

13650 JPRS-L-822-N

THE PRIMARY MECHANISM OF THE BIOLOGICAL ACTION OF RADIATION. Ya. L. Shekhtman. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 2, 172-84(1959). 25p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10805. (C.H.)

13651

ROLE OF DISTURBANCES IN PYRIMIDINE METABOLISM IN RADIATION INJURY. A. M. Kuzin and V. I. Tokarskaya (Tokarskaia)-Merenova (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 4, 68-76(1959).

The rate of incorporation of carbon from C^{14}O$_2$ into the purine and pyrimidine bases of DNA and RNA after γ irradiation of plants was investigated. It was shown that on irradiation of plants with a dose of 10,000 r a sharp decline occurred in the first 24 hr in the specific activity of DNA thymine and RNA uracil. The specific activity of cytosine was insignificantly reduced and that of the purine bases showed almost no departure from the controls. An hypothesis is advanced on the basis of the results that in the first hours after irradiation synthesis of DNA and RNA takes place, producing compounds with abnormal nucleotide ratios. The possible significance in the subsequent development of radiation injury of the appearance of these modified compounds of DNA and RNA is discussed. (auth)

13652

THE EFFECT OF TISSUE OXYGEN TENSION ON THE RADIO-SENSITIVITY OF LEUKAEMIA CELLS IRRADIATED IN SITU IN THE LIVERS OF LEUKAEMIC MICE.

H. B. Hewitt and C. W. Wilson (Westminster Hospital, London). Brit. J. Cancer 13, 675-84(1959) Dec.

A transplantation bioassay method was used to determine survival ratios among the leukemia cells released from the livers of leukemic mice immediately after their exposure to 800, 1400, and 2000 r total-body Co^{60} gamma radiation, a surviving cell being defined as one capable of securing successful transplantation of the leukemia. No significant difference was demonstrated between the survival ratios obtained for cells from mice breathing 95% oxygen and from mice breathing 95% air during irradiation. None of the survival ratios departed significantly from the linear log survival ratio-radiation dose curve obtained previously for leukemia cells irradiated in mice breathing air. A linear relationship was demonstrated between log survival ratio and radiation dose for the leukemia cells irradiated under anoxic conditions (in recently killed mice). Comparison of the log survival curves for cells irradiated in mice breathing air or oxygen and for the anoxic cells showed that the latter were more radioresistant by a factor 2.3. The slope of the log survival curve for cells irradiated in living mice was closely similar to that obtained by Puck and Marcus (1956) for human cancer cells (HeLa) irradiated under well-oxygenated conditions in vitro. (auth)

13653
PROTECTIVE ACTION OF IRRADIATED BONE MARROW CELLS. H. Meier and Barbara L. Brown (Children's Medical Center, Boston and Harvard Univ., Boston). Experientia 16, 145-6(1960). (In English)

Bone marrow was subjected to irradiation prior to transplantation. The protection afforded by isologous DBA$_1$, homologous C57BL/6, and heterologous (WR) bone marrow was evaluated by number of mice surviving a lethal dose. It was found that isologous bone marrow cells exposed in vitro up to 950 r exercised some protective effect; homologous and heterologous cells were either not effective, destroyed, or remained capable of reaction against the host. (T.R.H.)

13654
THE EFFECT OF PHENATIN ON THE COURSE AND RESULT OF DAMAGE BY PENETRATING RADIATION. S. Ya. Arbuzov and Ye. M. Anosova. Fiziol. Zhur. S.S.S.R. 43, 1191-4(1957). (Translated from Referat. Zhur. Biol. No. 19, abstract No. 89374).

Rabbits were irradiated with 800 r of Co^{60} gamma radiation with a dose intensity of 4.87 r per minute. One part of the animals was given for a period of 24 hours and 30 minutes prior to the irradiation 1 to 3 mg/kg doses of phenatin (a product of condensation of phenamine and nicotinic acid). The administration of phenatin continued following the irradiation (20 days twice daily, and 10 days once daily). The injection of phenatin produced a positive effect upon the course of radiation damage and increased the duration of life. It was possible, by administration of phenatin, to prevent death of 4 out of 10 rabbits while all the control animals perished. The administration of large doses of phenatin (5 and 10 mg/kg) or substitution by thiophenatin delayed death of the rabbits to a small degree only. The administration of phenatin prevented the drop of leukocytes. Combination of phenatin with bicaptan-mercamine is recommended.

13655
THE EFFECT OF A SUPERSONIC SOUND STIMULANT UPON THE COURSE OF THE SECRETORY PROCESS OF THE GASTRIC GLANDS IN DOGS IN ACUTE RADIATION SICKNESS. I. G. Chursin (Military Medical Academy, USSR). Trudy Voenno-Med. Akad. im. S. M. Kirova 74, 52-60(1957).

Investigations were carried out on 9 dogs with an isolated Pavlov stomach, a fistula of the stomach and of the duct of the parotid gland. In eight dogs a stereotype of conditioned reflexes with acid reinforcement was elaborated. Raw meat served as the food stimulant. Functional weakening of the cerebral cortex was produced by application of a supersonic sound stimulant (rattle). The dogs were subjected to general roentgen irradiation with a dose of 350 r. Disorders of the higher nervous activity and of the secretory function of the gastric glands were observed in the course of acute radiation sickness. The higher nervous activity and the secretory function of the gastric glands in dogs with functional weakening of the cerebral cortex were characterized by deeper and longer lasting changes.

CHEMISTRY

General and Miscellaneous

13656 NP-8582
Iowa State Univ. of Science and Technology, Ames.
SYNTHESIS OF ORGANOSILICON AND RELATED COMPOUNDS. Progress Report [for] January 1, 1960 to April 1, 1960. Henry Gilman, William J. Trepka, Oren L. Marrs, and Gerald Schwebke. 40p. Contract AF33(616)-6463.

Preparation of new organosilicon compounds are reported. One such compound is 5, 5, 10, 10-tetraphenyl-5, 10-dihydro-silanthrene; this cell molecule contains a maximum number of aromatic nuclei and has high termal stability. Synthesis of 5, 5, 10, 10-tetrabenzyl-5, 10-dihydrosilanthrene is also reported. This compound volatilizes at 510°C with decomposition. Progress in alkylation research is also reported. It was found that alkylation with alkyl phosphates such as trimethyl, tri-n-butyl, and triisobutyl phosphate is a method of choice. Alkylation was found to occur with C—Li and C—MgX compounds in which there is high steric hindrance. (J.R.D.)

13657 NP-8584
Akron, Ohio. Univ. Inst. of Rubber Research.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS. Technical Report No. 7 [for] Period December 1, 1959—February 29, 1960. Maurice Morton, V. R. Allen, and R. D. Gates. 38p. Contract Nonr-2573(00).

The sol-gel relations were determined for the degradation of sulfur vulcanizates of natural rubber by selective reduction of the sulfur crosslinks. The observed relations were distinctively different from those obtained for degradation of similar vulcanizates in air. The shapes of these curves are interpreted in terms of network chain entanglements and crosslink density. The results add credence to the prior conclusions that natural rubber vulcanizates degrade oxidatively via random scission of network chains. The sol-gel relations during network formation were used to calculate the molecular weight between entanglements for uncrosslinked natural rubber. The observed differences in the reported values of this parameter are attributed to a variable term which relates the effectiveness of the entanglement to chain flexibility. Applying this term, better agreement is obtained between the reported values. The determination of the polymer-solvent interaction coefficient for the Viton A-MEK system by vapor pressure measurements gave a negative value for v_2 greater than 0.135. Degradation studies of Viton A showed that cross-linking accompanies degradation when the elastomer is exposed to high temperatures (275°C). A post-cure heat treatment (15 to 24 hours at 200°C retards the rate of degradation of the vulcanizate during subsequent heat aging tests. (auth)

13658 NP-8588

Department of the Interior. Office of Saline Water, Washington, D. C.

SALINE WATER CONVERSION REPORT FOR 1959. Jan. 1960. 125p.

Developments in saline water conversion are reported in three parts: research, processes, and demonstration plants. Among the things investigated are scale deposition, hydrate formation, osmionic processes, electrolytic methods, membranes, adsorption on porous graphite electrodes, and algae. Four processes are available for large-scale conversion: conventional distillation, solar distillation, membrane diffusion, and freezing. Three types of distillation were selected for demonstration plant testing, namely, long-tube vertical multiple-effect, multi-stage flash, and forced-circulation vapor compression distillations; an electrodialysis membrane process was also selected for testing. Criteria for process selection are given. Two methods still in the laboratory stage are solvent extraction and gas hydrate formation. (D.L.C.)

13659 TID-5737

Fordham Univ., New York

THE EFFECT OF LIGAND STRUCTURAL FACTORS IN β DIKETONES ON THE RATE OF METAL COMPLEX FORMATION (thesis). Alfred V. Celiano. 1960. 97p. Contract AT(30-1)-906. OTS.

Studies were conducted to determine the stepwise formation constants and generalizations concerning the effect of metal ion and ligand characteristics on the stability of the resulting coördination compounds. The rate of first complex formation between Cu(II) and a series of β diketones was followed conductometrically. The ligands chosen include benzoylacetone, p-chlorobenzoylacetone, p-nitrobenzoylacetone, p-methoxybenzoylacetone, and dibenzoylmethane. (J.R.D.)

13660 JPRS-2501

THE KINETICS OF ISOTOPE EXCHANGE. S. Z. Roginskii (Roginskiy). Translated from Doklady Akad. Nauk S.S.S.R. 100, 939-42(1955). 6p. OTS.

A mathematical treatment of isotopic exchange in dynamic conditions is given to show that it is no more complex than the stationary case. The dynamic process offers advantages in cases of rapid reactions. (T.R.H.)

13661 JPRS-2511

ON THE FORMATION OF A COMPLEX COMPOUND OF URANYL NITRATE. V. M. Vdovenko, A. A. Lipovskii (Lipovskiy), and M. G. Kuzina. Translated from Zhur. Neorg. Khim. 11, 970-74(1957). 9p. OTS.

A spectrophotometric study was made of complex formation by UO_2^{2+} in acetone with nitrates of pyridine and aniline being added. A compound $(C_5H_5NH_2)UO_2\cdot(NO_3)_4 2H_2O$ was precipitated and dried which exhibited a stability of (4.8 ± 1.1) × 10^3 for pyridine and (3.6 ± 0.7) × 10^3 for aniline. The stability depends on the solvent and the amount of H_2O in the organic phase. (T.R.H.)

13662 JPRS-2521

INVESTIGATION OF THE SYSTEM URANYL NITRATE–WATER–DIBUTYL ETHER. SOLUBILITY ISOTHERM AT 25°. V. M. Vdovenko and I. G. Suglobova. Translated from Zhur. Neorg. Khim. 3, 1403-9(1958). 15p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13881.

13663 UCRL-Trans-522(L)

COMPLEX COMPOUNDS OF RARE-EARTH ELEMENTS. E. A. Terent'eva. Translated by Esther Goldberg from Uspekhi Khim. 26, 1007-35(1957). 46p. JCL or LC.

A literature review on properties of rare-earth complexes is presented. The complexes discussed include those formed by rare earths with inorganic and organic additives, amines, β-diketones, polyatomic phenols, alizarin-S, and cyclopentadienal sodium. (C.J.G.)

13664

ELECTROLYTIC PRODUCTION OF LAYERS OF URANIUM COMPOUNDS AT SURFACE DENSITIES OF 1-3 mg/cm². V. F. Titov. Atomnaya Energ. 8, 257-8(1960) Mar. (In Russian)

Uniform films of 1 to 3 mg/cm² were prepared by electrodeposition from ammonium oxalate solutions. The best results were obtained with 0.2 M $(NH_4)_2C_2O_4$ at pH 9, 1 to 3 mg U/ml of electrolyte, and 80°C. (R.V.J.)

13665

SOLUBILITY OF U(IV) HYDROXIDE IN CAUSTIC SODA. N. P. Galkin and M. A. Stepanov. Atomnaya Energ. 8, 258-61(1960) Mar. (In Russian)

Previously it was postulated that $U(OH)_4$ is amphoteric and that the equilibrium constant for $U(OH)_4 + OH^- \rightarrow H_3UO_4^- + H_2O$ is 1.7×10^{-4}. To verify this for a wider range of alkali concentrations, U(IV) was precipitated from 2 ml of U–HCl solution by 0.34 N caustic soda. The data on the $U(OH)_4$ – NaOH system and the equilibrium precipitation at 7.0 N alkali concentration show that the previous postulation holds only for low alkali concentrations (up to 0.5 N). The linear dependence of uranium(IV) content on alkali concentration disappears at higher alkali concentrations. Upon reaching the maximum value at 2 N alkali, uranium concentration begins to drop. (R.V.J.)

13666

CATALYSED OXIDATION OF U(IV) IN ACID MEDIA CONTAINING IRON COMPOUNDS. Vikt. I. Spitsyn, G. M. Nesmeyanova, and G. M. Alkhazashvili. Atomnaya Energ. 8, 261-2(1960) Mar. (In Russian)

The effects of iron compounds on the oxidation process were studied using pure UO_2 and Fe^{2+} and Fe^{3+} sulfates in various concentrations of sulfuric and nitric acids. MnO_2 and $KClO_3$ were used as oxidizers. With sulfuric acid concentration at 5 g/l, additions of 0.5% Fe^{3+} salts promote complete dissolution within an hour. An increase of Fe^{3+} salts up to 5% reduces the dissolution time; with sulfuric acid concentration at 150 g/l, the respective times are 40 min and 30 min. The results show that iron ions speed dissolution even with reduced acid concentration. The Fe^{3+} salts are strong U(IV) oxidizers. The effects of large amounts of Fe^{3+} are more pronounced with nitric acid, which in this case is a weak oxidizer. With MnO_2 and $KClO_3$ the Fe^{3+} ions act as catalyzers as long as U^{4+} is present. During the process, Fe^{2+} produces a catalytic effect. The catalytic mechanism is described by a reaction which indicates that iron ions are electron transmitters between oxidizers and uranium. (R.V.J.)

13667

THE DEHYDRATION PROPERTIES OF SOME HYDRATED RARE EARTH OXALATES, AND EXCEPTIONAL BEHAV-

IOUR OF CERIUM(III) OXALATE. A. Glasner and M. Steinberg (Hebrew Univ., Jerusalem). Bull. Research Council Israel, Sect. A 8A, 174-8(1959) Dec. (In English)

Lanthanum, cerium(III), samarium, and other rare earth oxalates may be dehydrated at 320°C *in vacuo* without decomposition. In air, cerium(III) oxalate is converted at this temperature into cerium dioxide. None of the other rare earth oxalates behave in this manner. The exceptional behavior of cerium(III) oxalate as well as the similar behavior of plutonium(III) and americium(III) oxalates, are attributed to the susceptibility of these trivalent cations to oxidation to the quadrivalent state. (auth)

13668

THE USE OF TRACER ATOMS IN THE PHYSICOCHEMICAL STUDY OF SOME INORGANIC POLYCOMPOUNDS. Victor Spitsyn (Moscow Univ.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 15-31(1959).

Tracer atoms in self-diffusion and isotopic exchange were used to study the formation of aquopoly and heteropoly compounds containing Si, Mo, P, and/or W. Other methods were also used, e.g., dialysis, polarography, absorption spectra, and chromatography were used to study sodium paratungstate solutions. Isotopic exchange is shown to proceed easily with strongly acidified solutions of Na_2WO_4 and Na_2MoO_4. High mobility of H and O atoms in a number of the compounds was demonstrated by isotopic exchange of D_2O. Infrared spectroscopy revealed a large number of hydrogen bonds and two or three forms of coordinated water in aquopoly tungstates. The formation of the compounds is discussed and the suggestion made that hydrogen bonds between the acid anions participate in the process of formation. The structure of compounds of the phosphomolybdate or silicotungstate type may be expressed as $H_mRO_4(H_2XO_4)_4(H_2XO_4)_8 \cdot nH_2O$, where R is the nonmetal, m is the basicity of the nonmetal acid, and X is Mo or W. (D.L.C.)

13669

RARE EARTH AND YTTRIUM FLUORIDES. SOLUBILITY RELATIONS IN VARIOUS MOLTEN $NaF-ZrF_4$ AND $NaF-ZrF_4-UF_4$ SOLVENTS. W. T. Ward, R. A. Strehlow, W. R. Grimes, and G. M. Watson (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data 5, 137-42(1960) Apr.

The solubilities of the trifluorides of Ce, La, Sm, and Y were determined in a $NaF-UF_4-ZrF_4$ solvent of composition 50-4-46 mole %, respectively, at 550 to 850°C. The solubility of CeF_3 in $NaF-ZrF_4$ solvents of varying composition was also determined. The log solubility vs. 1/T plot for the $NaF-UF_4-ZrF4$ solvent is not linear except for YF_3. An empirical correlation for the solubilities of Ce, La, and Sm fluorides is derived in the form of a solubility vs. cationic radius plot, which could be used to predict the solubilities of other rare-earth fluorides to ±5%. The solubilities of CeF_3 and LaF_3 are found to be additive, whereas those for YF_3 and SmF_3 are not. Phase diagrams are given for the ternary systems $NaF-CeF_3-ZrF_4$ (incomplete), LaF_3-CeF_3-solvent, and SmF_3-CeF_3-solvent (solvent = $NaF-UF_4-ZrF_4$). It is shown that a rare-earth poison depletion process from a molten fluoride fuel by solid-solvent extraction is feasible. (D.L.C.)

13670

POLYPHENYL ETHERS AS HIGH-TEMPERATURE RADIATION-RESISTANT LUBRICANTS. C. L. Mahoney, E. R. Barnum, W. W. Kerlin, K. J. Sax, and W. S. Saari (Shell Development Co., Emeryville, Calif.). J. Chem. Eng. Data 5, 172-80(1960) Apr.

The potentialities of polyphenyl ethers as lubricants capable of withstanding high temperatures and large amounts of radiation in an oxidizing atmosphere were investigated. Among the properties measured in the range 100 to 1000°C were the melting point, viscosity-temperature coefficients, effects of radiation on viscosity, volatility and flash points, effects of additives and radiation on oxidation stability, thermal stability, coking tendencies, and lubrication characteristics. Comparisons with lubricants like silicones are made. (D.L.C.)

13671

OBSERVATIONS ON THE RARE EARTHS. LXXI. CHEMICAL AND ELECTROCHEMICAL STUDIES OF IODIDE SYSTEMS IN ANHYDROUS N:N'-DIMETHYLFORMAMIDE. T. Moeller and V. Galasyn (Univ. of Illinois, Urbana). J. Inorg. & Nuclear Chem. 12, 259-65(1960) Feb.

Solvated rare-earth metal iodides having the general formula $LnI_3 \cdot 8DMF$ (Ln = La, Pr, Nd, Sm, or Gd; DMF = N:N'-dimethylformamide) were prepared by reaction of the hydrated acetate with acetyl iodide in dimethylformamide or by metathesis between the anhydrous chloride and potassium iodide in the same solvent. Several properties of the crystalline salts were determined. The solvates dissolve readily in N:N'-dimethylformamide, giving solutions exhibiting weak electrolyte behavior. Such solutions yield amalgams on electrolysis, but conclusive evidence for the deposition of the metals on solid cathodes was not obtained. (auth)

13672

SYNTHESIS OF Mn^{52} AND As^{74} LABELLED PHTHALOCYANINES. H. A. Rutter, Jr. and J. D. McQueen (Baltimore City Hospitals, Baltimore). J. Inorg. & Nuclear Chem. 12, 361-3(1960) Feb.

Procedures for the synthesis of Mn^{52}-labeled manganous phthalocyanine and As^{74}-labeled chloroarsenic phthalocyanine are described. Chloroarsenic phthalocyanine was found to have a stability similar to that of chloroaluminum phthalocyanine. (D.L.C.)

13673

THE DECOMPOSITION OF NITRIC ACID CO-EXTRACTED WITH URANYL NITRATE INTO TRIBUTYL PHOSPHATE. Taichi Sato (Government Chemical Industrial Research Inst., Tokyo). J. Inorg. & Nuclear Chem. 12, 382-3(1960) Feb.

The decomposition of nitric acid co-extracted with uranyl nitrate into tributyl phosphate-kerosene solutions is studied in terms of the initial concentrations of nitric acid and uranyl nitrate in the aqueous phase and over a period of two months in the presence of light. The results show that decomposition reaches approximate equilibrium after one month, that the decomposition percentage is proportional to the initial concentrations of nitric acid and uranyl nitrate in the aqueous phase, and that it is larger at low tributyl phosphate concentrations than at high concentrations. Several possible interpretions of the data are given. (D.L.C.)

13674

HEATS OF MIXING OF NON-ELECTROLYTE SOLUTIONS. I. ETHANOL + BENZENE AND METHANOL + BENZENE. A. G. Williamson and R. L. Scott (Univ. of California, Los Angeles). J. Phys. Chem. 64, 440-2(1960) Apr.

A calorimeter suitable for measuring heats of mixing of fluorocarbon + hydrocarbon mixtures is described; it is similar to that of Adcock and McGlashan but uses a thermistor as the temperature sensitive element. In testing the calorimeter a discrepancy between the measurements and the published data for the system ethanol + benzene at 45°C was observed; the new results were confirmed by new measurements by the original workers.

The new data on ethanol + benzene at 45°C and methanol + benzene at 25 and 45°C correlate well with the available data for other alcohol + benzene systems. (auth)

13675

NATURE OF THE REDUCTION OF URANIUM SPECIES IN SULPHURIC ACID SOLUTION. P. J. Elving, A. F. Krivis, and H. H. Bauer (Univ. of Michigan, Ann Arbor). J. Polarog. Soc. No. 2, 2p., 1959.

The heterogeneous rate constant, k_e, and the transfer coefficient, α, were measured for the electrode processes in the successive a-c polarographic reductions of uranium in sulfuric acid solution from U(VI) to U(III). For a solution 1.28 m$\underline{M}$ in uranyl ion and 0.18 $\underline{M}$ in H_2SO_4, k_e, the rate of the electrode reaction at a standard state or the equilibrium potential, was found to be 6.1×10^{-2} and 3.1×10^{-2} cm/sec for the U(VI)-U(V) and U(IV)-U(III) reductions, respectively; α, defined as the fraction of the applied potential effective in the forward reaction, was found to be 0.62 and 0.71, respectively. The a-c efficiency, P, defined as the ratio of the observed faradaic admittance to that calculated from theory, was found to be 0.18 and 0.19 in the same order, which means that these reductions are partially reversible with an a-c efficiency of about 20%. Since no a-c polarographic wave could be observed for the U(V)-U(IV) reduction (i.e., P = 0), it is irreversible from the a-c point of view. These results were obtained in the frequency range 100 to 1000 cps. (D.L.C.)

13676

POLYMERIZATION CATALYSTS FOR ETHYLENE. PART I. RARE EARTH OXIDES. C. P. Brown and J. Saunders (British Nylon Spinners Ltd., Pontypool, Mon., Eng.). J. Polymer Sci. 43, 579(1960) Apr.

The possibility of using rare earth oxides as catalysts for the polymerization of ethylene was investigated and found to be promising. The rare earth oxides studied were those of Ce, Nd, Sm, Gd, Dy, Er, and Yb; monazite sand was also included. The catalyst was prepared by supporting the oxide on γ-alumina and activating with heat. Lithium aluminum hydride was introduced into the polymerizations as activator and scavenger. The oxides of Dy and Yb were found to be the most effective catalysts, followed by those of Nd and Gd; cerium oxide was ineffective. Rare earth oxide-transition metal oxide catalyst mixture were tried and found to be less effective than either oxide alone. None of the above catalysts induced the polymerization of propylene, acrylamide, acrylonitrile, vinyl acetate, or methyl methacrylate. (D.L.C.)

13677

TRITIUM-LABELED COMPOUNDS. III. ALDOSES-1-t. H. S. Isbell, H. L. Frush, N. B. Holt, and J. D. Moyer. J. Research Natl. Bur. Standards 64A, 177-80(1960) Mar.-Apr.

In a new method for preparing aldoses labeled with tritium at carbon 1, the aldonic lactone is reduced with lithium borohydride-t in pyridine solution. The method is suitable for preparing aldoses-1-t having high specific activities. The crude product contains a substantial proportion of the corresponding alditol-1-t, but the pure aldose-1-t is readily separated by fractional recrystallization or paper chromatography. By means of an isotope-dilution technique, yields were determined for the following aldoses-1-t and the corresponding alditols-1-t: D-arabinose-1-t, D-xylose-1-t, D-ribose-1-t, D-glucose-1-t, D-galactose-1-t, D-mannose-1-t, L-rhamnose-1-t, maltose-1-t, and lactose-1-t. These labeled materials were prepared by reducing the corresponding lactones with sodium amalgam in tritiated water. Although this latter method is not suitable for preparing labeled aldoses of high specific activity, the products are more readily purified than those obtained by reducing the lactones with lithium borohydride-t. D-Glucose-1-t, obtained by each of these reduction methods, was oxidized with bromine, and the resulting D-gluconic acid was found to be nonradioactive. In the samples oxidized, tritium was present only at Cl. An apparatus used for reclaiming tritiated water by freeze-drying is depicted; it incorporates an efficient device for trapping entrained solids or liquids. (auth)

13678

FLUORESCENCE SPECTRA OF SOLUTIONS OF URANYL NITRATE AT LIQUID AIR TEMPERATURE. PART I. RAPIDLY COOLED SOLUTIONS. D. D. Pant and D. P. Khandelwal (D.S.B. Government Coll., Nainital, India). Proc. Indian Acad. Sci., Sec. A 51, 60-74(1960) Feb. (In English)

Photometric studies on the fluorescence spectra of rapidly cooled aqueous and alcoholic solutions of uranyl nitrate are reported. Five distinct series of bands, designated as α, β', γ, δ, and α' appear, depending upon concentration, pH, solvent, etc. From their conditions of enhancement and suppression and close analogy with corresponding room temperature spectra reported earlier, the α and γ-bands are shown to be due to the species UO_2^{2+} (hydrated) and $UO_3UO_2^{2+}$. Higher hydrolyzed species give δ-bands. The α'-bands, which appear in alcoholic solutions also, are attributed to $UO_2(NO_3)_2 \cdot xH_2O$. The assignment of β'-bands is not certain. The intensity distribution in various series is studied and it is found that relative to α series the distribution is largely shifted away from the (0, 0) band in α' series and towards the (0, 0) band in γ series. The α' and γ bands disappear around −60°C. which corresponds with the transformation temperature of ice structure. Various characteristics in the spectra are discussed on the basis of environmental differences in the species. (auth)

13679

INFRARED ABSORPTION STUDY OF URANYL SALT SOLUTIONS IN ORGANIC SOLVENTS. I. THE SPECTRA OF COORDINATION BOUND WATER IN HYDRATED URANYL NITRATE IN THE REGION OF VALENCE VIBRATION FREQUENCIES. V. M. Vdovenko and D. N. Suglobov. Zhur. Fiz. Khim. 34, 51-6(1960) Jan. (In Russian)

Measurements were made of the infrared absorption spectra of solutions of hydrated uranyl nitrates (with various isotope modifications of water) in ethyl ether, β, β'-dichlorodiethyl ether, dipropyl sulphide, acetonitrile, and nitromethane in the region of the OH (OD) valence vibrations. The conclusion was drawn that the water in the coordination sphere of hexa-valent uranium is polarized and that acid-base types of linkages are formed between the hydrate water and the solvent molecules. When an additional number of water molecules is coordinated with the dihydrate of uranyl nitrate they are less firmly bound to uranium than the first two molecules. The acidity of the water coordinated with uranyl nitrate confirms the comparability of the mechanism of ether extraction for the hydrates of uranyl nitrate, on the one hand, and for acids and metal acid complexes on the other. (tr-auth)

13680

KINETICS OF DEUTEROEXCHANGE BETWEEN MONODEUTEROTOLUENE, MONODEUTERODIPHENYL AND MONODEUTERONAPHTHALENE ISOMERS WITH LIQUID HYDROGEN BROMIDE AND WITH POTASSIUM AMIDE IN LIQUID AMMONIA SOLUTION. E. N. Yurigina, P. P. Alikhanov, E. A. Izrailevich, P. N. Manochkina, and A. I. Shatenshtein (Karpov Inst. of Physics and Chemistry, USSR). Zhur. Fiz. Khim. 34, 587-93(1960) Mar. (In Russian)

The partial rate factors of deuteroexchange between monodeuterotoluene, monodeuterodiphenyl, and monodeuteronaphthalene derivatives and hydrogen bromide, as well as 0.02 N potassium amide in liquid ammonia at 25° were determined. The sequences of the partial rate factors of isotopic exchange between non-equivalent deuterium atoms in toluene and diphenyl molecules are not the same for reactions with acid and with base owing to the difference in mechanisms of these reactions, in which are manifested the different aspects of the mutual influence of atoms in the hydrocarbon molecule, i.e., the conjugative and inductive effects. In naphthalene the alpha-position is the most reactive, independent of the reactant. This is ascribed to the specific features of polarization of the naphthalene molecule. Liquid hydrogen bromide was shown to be a solvent accentuating the difference in reactivities of non-equivalent hydrogen atoms, whereas, potassium amide in liquid ammonia solution on the contrary levels them off. A method for the synthesis of monodeuterodiphenyl isomers is described. (auth)

13681

COMPARISON OF REGULARITIES IN DEUTERIUM EXCHANGE AND IN OTHER REACTIONS. A. I. Shatenshtein (Karpov Inst. of Physics and Chemistry, USSR). Zhur. Fiz. Khim. 34, 594-602(1960) Mar. (In Russian)

Deuterium exchange in hydrocarbons proceeds as an acid-base reaction. The acids react with the electronegative carbons of the aromatic CH-bond (or with the π-electrons of the ring). On deuteroexchange with bases the hydrogen of the CH-bond protonizes. Because of the different mechanism of deuteroexchange with acid and base, on reaction with them one may reveal different aspects of the mutual influence of atoms in the hydrocarbon molecule. The reason for the similarity in the regularities for deuteroexchange and electrophylic hydrogen substitution in the aromatic nucleus is that hydrogen acids and aprotonic acid-like substances, being electrophylic, react in a like manner with the aromatic ring, participating in the reaction as bases, i.e., electron donors. The similarity in reaction between deuteroexchange with KNH_2 in NH_3 solution and the metallation, alkylation, isomerization, and dimerization of olefines with participation of bases is that they all proceed according to a protophylic carbanionic mechanism, the hydrocarbon playing the part of an acid. The rate and selectivity of deuteroexchange depend to a high degree upon the polarity of the bond between the substrate and reactant in the activated state. There are intermediate states between the associative and ionization mechanisms of the reaction. (auth)

13682

THE SOLUBILITY OF BORON TRIFLUORIDE IN ANISOLE, PHENETOLE, β,β'-DICHLORODIETHYL ETHER (CHLOREX) AND SULFURIC ACID. A. V. Makarov and G. M. Panchenkov (Lomonosov Inst. of Fine Chemical Tech., Academy of Sciences, USSR). Zhur. Fiz. Khim. 34, 639-43 (1960) Mar. (In Russian)

An arrangement is described for determining the solubility of boron trifluoride in various solvents. This consists of two gasometers connected in series and a thermostatted reaction vessel. The accuracy of the method is ±5%. The temperature dependence of the solubility of boron trifluoride in anisole, phenetole, chlorex, and sulfuric acid is investigated at 5 to 170°C. At 5 to 7°C the solubility was found to be respectively 230, 196, 201, and 120 cm^3 BF_3/cm^3 solvent. It is shown that of the complexes of BF_3 with anisole, phenetole, and chlorex, the last is the most stable and the first the least stable. (auth)

13683

SUBLIMATION APPARATUS. (to United Kingdom Atomic Energy Authority). British Patent 833,321. Apr. 21, 1960.

A sublimation apparatus said to be useful for UCl_6 is described. A cylindrical heating chamber and a condenser tank are arranged end to end with a heating unit on wheels which can be rolled up to enclose the heating chamber. Shelves with trays hold the charge. Cooled baffles in the condenser collect the sublimed material. (T.R.H.)

13604

PROCESS FOR THE PRODUCTION OF TITANIUM OR ZIRCONIUM SUBCHLORIDES. (to National Distillers and Chemical Corporation). British Patent 833,462. Apr. 27, 1960.

A continuous method is presented for producing Ti and Zr chlorides mixed with NaCl at low temperatures and atmospheric pressures. In an example, 24 parts Na are dispersed over 207 parts of finely divided NaCl in a stirred reactor with He atmosphere. The stirrer is started and 96 parts of $TiCl_4$ are added. The whole is maintained at 290 to 300°C. $TiCl_2$ and NaCl are obtained. (T.R.H.)

13685

PROCESS FOR OBTAINING ANHYDROUS FLUORIDES. (to Deutsche Gold-und Silber-Scheideanstalt Vormals Roessler). British Patent 833,580. Apr. 27, 1960.

A description is given of a process for dehydrating fluorides by slowly heating in a stream of HF. Rotary tube furnaces can be used, but a stationary reactor avoids sealing of moving parts. Vibratory action moves the hydrate material through the reaction zones. For the first part of the reaction a temperature of 150 to 200°C is used, with the temperature increasing to between 350 and 550°C near the outlet. The countercurrently flowing HF is preheated to a temperature above the dew point of the aqueous HF vapor formed. (T.R.H.)

Analytical Procedures

13686 · NMI-1234

Nuclear Metals, Inc., Concord, Mass.

ANALYSIS OF OXYGEN IN BERYLLIUM. A. R. Gilman and S. Isserow. May 3, 1960. 24p. Contract AT(30-1)-1565. OTS.

Chemical and radioactivation analyses for O in Be were compared using specimens cut from three Be castings. Two chemical methods were employed: HCl volatilization of Be metal as chloride, and selective dissolution of Be in a bromine-methanol solution. In both methods, a residue containing O as BeO is analyzed for Be. In radioactivation, O was converted to 2.03-minute O^{15} by the gamma-neutron reaction with betatron-generated bremsstrahlung. Scintillation counting of annihilation gammas utilized pulse discrimination to reduce background. Irradiation of water was used as a standard for comparison. Computer analysis of count-time data resulted in an improved rejection of interference. Values for O reported by these methods showed poor agreement. The chemical methods did not agree with one another and were not consistent. Radioactivation gave lower values which exhibited good consistency. (auth)

13687 TID-5772

Ionics, Inc., Cambridge, Mass.

RADIUM PROCEDURE. Progress Report covering Period

March 16 to April 15, 1960. Apr. 18, 1960. 18p. Contract AT(30-1)-2470. OTS.

Development of a method for determination of radium isotopes is described in which reliability and rapidity are emphasized. A quaternary amine with low aqueous solubility in acid systems was investigated for use in radium ion exchange. Results showed that the chemical yield for a procedure using this material is a function of the size of aliquot mounted on a planchet. A method is also under investigation for determining Ra^{223} in samples within 1 hour of the time at which a total Ra count was made. The method is based on the extraction of Pb^{211} (Bi^{211}) from an aliquot of the concentrate produced by the radium procedure, and subsequently measuring the alpha decay of Bi^{211} (Po^{211}). A diagram of the actinium decay series is included for illustration and methods of calculating results are described. An investigation is also underway to develop an accurate and fast thorium procedure. High molecular weight tertiary amines are being used to extract U from sulfuric acid solutions while primary amines are used to subsequently extract Th. Results so far obtained are encouraging. Data from analysis of samples containing known concentrations of Ra^{226} and Th^{230} are tabulated along with other data on Ra error as a function of Th concentration. Techniques are described which were used in analysis of U ores for Th and U. Procedures for Th and Ra by extraction into TTA as used at the Idaho Falls laboratory were tested. (For preceding period see TID-5656.) (J.R.D.)

13688 Y-1294

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. A PRECISE METHOD FOR DETERMINING VANADIUM IN ESSENTIALLY PURE VANADIUM METAL. W. C. Dietrich. Mar. 8, 1960. 10p. Contract W-7405-eng-26. OTS.

A method of analysis for vanadium in essentially pure vanadium metal is presented. Precision resulting in a limit of error (0.95) for a single determination of ±0.079% is achieved by oxidizing the weighed and dissolved sample to vanadium(V) and reacting this solution with a weighed slight excess of ferrous ammonium sulfate hexahydrate. The excess reagent is then back-titrated with standard potassium dichromate solution, the titration representing less than 1% of the amount of vanadium present. (auth)

13689

INTERACTION OF BETA PARTICLES WITH MATTER. QUANTITATIVE DETERMINATION OF HYDROGEN, CARBON, NITROGEN, OXYGEN, AND FLUORINE MATERIALS. Peter R. Gray, Donald H. Clarey, and William H. Beamer (Dow Chemical Co., Midland, Mich.). Anal. Chem. 32, 582-9(1960) May.

Binary and ternary compounds and mixtures can be uniquely analyzed by a measurement of their β-ray transmittance and backscatter intensities. A mathematical equation for β-ray backscattering is developed which correlates the experimental data with the theoretical sample analysis. The standard deviation in the experimentally determined weight fraction of hydrogen in hydrocarbons and in hydrogen-containing ternary compounds is less than 0.03%. Analysis of ternary compounds is fast, simple, accurate, and nondestructive. (auth)

13690

RADIOCHEMICAL DETERMINATION OF CERIUM BY LIQUID-LIQUID EXTRACTION. J. J. McCown and R. P. Larsen (Argonne National Lab., Lemont, Ill.). Anal. Chem. 32, 597-9(1960) May.

A rapid and quantitative radiochemical method for the determination of cerium activity produced in nuclear fission is based on the difference in extractability of cerium(III) and cerium(IV) with bis(2-ethylhexyl)-phosphoric acid. The extraction procedure affords excellent separations from the other fission elements as well as a considerable saving in time and effort. (auth)

13691

DETERMINATION OF NEPTUNIUM IN URANIUM—FISSION PRODUCT MIXTURES. INITIAL EXTRACTION WITH METHYL ISOBUTYL KETONE. William J. Maeck, Glenn L. Booman, Maxine C. Elliott, and James E. Rein (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 32, 605-7(1960) May.

A method for the separation and determination of neptunium in uranium—fission product mixtures uses a two-cycle extraction system. Neptunium is oxidized to 6+ with permanganate and quantitatively extracted as a nitrate complex into methyl isobutyl ketone from an acid-deficient aluminum nitrate salting solution containing tetrapropylammonium nitrate. Neptunium is stripped from the ketone phase and simultaneously reduced to 4+ by contact with ferrous chloride—hydroxylamine solution, then quantitatively extracted into thenoyltrifluoro acetone-xylene. The extraction of uranium and plutonium is less than 0.1 and 0.01%, respectively. Ruthenium and zirconium, the only 80-day cooled fission products which follow the neptunium, are decontaminated to greater than 1×10^4. (auth)

13692

DETERMINATION OF THE STOICHIOMETRY OF URANIUM DIOXIDE. POLAROGRAPHIC DETERMINATION OF URANIUM(VI) IN URANIUM DIOXIDE. Hisashi Kubota (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 610-12 (1960) May.

The deviation of the composition of uranium dioxide from the stoichiometric oxygen—uranium ratio of 2.000 is calculated from the assay for the uranium(VI) in the oxide. The sample is dissolved in hot phosphoric acid under an inert atmosphere to preserve the oxidation states of the metal, and the uranium(VI) is determined polarographically in a phosphoric-perchloric acid medium. Because this is a direct determination of the deviation from stoichiometry, it is best applied to samples which are nearly stoichiometric, and the composition of a uranium dioxide sample which has an oxygen—uranium ratio of 2.03 or less can be determined to within 0.001 oxygen atom. (auth)

13693

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH 3-(2-ARSONOPHENYLAZO)-4, 5-DIHYDROXY-2, 7-NAPHTHALENEDISULFONIC ACID (TRISODIUM SALT). H. Perry Holcomb and John H. Yoe (Univ. of Virginia, Charlottesville). Anal. Chem. 32, 612-17(1960) May.

A more comprehensive study of the Fritz and Johnson-Richard arsenazo method (4) for the spectrophotometric determination of uranium is presented. Arsenazo instantaneously forms a stable blue complex with uranyl ions with a maximum absorbance at 590 mμ. The mole ratio of uranyl ion to compound is 1 to 1. The color reaction conforms to Beer's law and has a sensitivity of 1 part of uranium in 30,000,000 parts of solution. Tolerances to diverse ions, effect of temperature, and the separation of uranium from interfering ions by ether extraction of uranyl nitrate have been investigated. The accuracy of the new method compares well with the dibenzoylmethane method. The sensitivity of arsenazo is about 50% higher than that of dibenzoylmethane. The method has been applied to the analysis of synthetic samples containing uranium and various interfering ions, as well as to a number of uranium ores. (auth)

13694

CONTEMPORARY CARBON-14. THE p-CYMENE METHOD. F. N. Hayes, Elizabeth Hansbury, and V. N. Kerr (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 32, 617-20(1960) May.

A world-wide survey program has been set up for investigating carbon-14 in the atmosphere by conversion of oils to p-cymenes. Details of the sampling, the chemical conversions, and the liquid scintillation counting procedures are given. (auth)

13695

DETERMINATION OF CHLORIDE BY CATHODIC STRIPPING POLAROGRAPHY. APPLICATION TO SOLUTIONS OF URANYL SULFATE. R. G. Ball, D. L. Manning, and Oscar Menis (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 621-3(1960) May.

Cathodic stripping polarography is useful for the determination of low concentrations of chloride in aqueous solutions of uranyl sulfate. Chloride in the concentration range of 0.2 to 2 μg per ml is deposited as insoluble mercurous chloride on a mercury-pool microelectrode at a potential of +0.4 volt vs. S.C.E. for 15 minutes with stirring. The deposit is then stripped from the electrode by scanning the potential to less positive values. The peak height of the recorded current-voltage curve is measured and related to the chloride concentration through a calibration curve. The coefficient of variation is about 5%. This technique is significantly more sensitive than conventional polarographic methods. (auth)

13696

QUANTITATIVE RADIOASSAY OF PAPER CHROMATOGRAMS BY LIQUID SCINTILLATION COUNTING. APPLICATION TO CARBON-14—LABELED SALICYLIC ACID. William F. Bousquet and John E. Christian (Purdue Univ., Lafayette, Ind.). Anal. Chem. 32, 722-3(1960) May.

The possible radioassay of paper-chromatographed C^{14}-labeled salicylic acid by immersion of the paper in the liquid scintillator and subsequent counting was investigated. The effect of the paper on the counting rate and the most appropriate solvent system for use were studied. Spurious counts were obtained using a non-acidified solvent, but a linear relationship between applied and observed activities was obtained with an acidified solvent; the observed activities were approximately $\frac{1}{4}$ of the theoretical activities. No relationship between the count and size of the paper was observed. (D.L.C.)

13697

DETERMINATION OF DEUTERIUM IN WATER AND ORGANIC COMPOUNDS. Nabuo Tamiya (Tokyo Medical and Dental Univ.). Anal. Chem. 32, 724-5(1960) May.

Deuterium in water and organic compounds is usually determined by combustion to water, reduction to hydrogen by heated zinc, and mass spectrometric analysis. The method is modified in such a way that memory effects of the apparatus and isotope fractionation from partial reduction are avoided. The zinc reductant is replaced with a platinum-coated zinc reductant, and the reduction tube is completely redesigned. However, the combustion tube still has a memory effect and hence must be pretreated twice with the sample. (D.L.C.)

13698

SPECTROGRAPHIC DETERMINATION OF URANIUM 235. PART I: USING PHOTOGRAPHIC RECORDING AND D. C. ARC EXCITATION. Ted Lee, A. L. Hallowell and Lewis H. Rogers (Oak Ridge Gaseous Diffusion Plant, Tenn.). Appl. Spectroscopy 14, No. 2, 39-42(1960).

The precision obtained using d-c arc excitation, photographic recording, and a 21-foot Jarrell-Ash Wadsworth spectrograph in the second order is described. Measurements were made employing different spectral lines, slit widths, and slit types. For each determination consisting of the average of 10 measurements, a precision of ±0.04 wt. % U^{235}, expressed at the 95% confidence level, was obtained in the vicinity of naturally occurring uranium (0.7115% U^{235}). (auth)

13699

DETERMINATION OF TRACES OF CERTAIN RARE EARTHS IN URANIUM COMPOUNDS BY ION EXCHANGE AND SPECTROGRAPHY. Joel A. Carter (Oak Ridge Gaseous Diffusion Plant, Tenn.) and John A. Dean (Univ. of Tennessee, Knoxville). Appl. Spectroscopy 14, No. 2, 50-2(1960).

An ion exchange separation followed by a spectrographic determination was developed for certain of the rare earths present in uranium compounds. This method permits the determination of dysprosium, erbium, europium, gadolinium, neodymium, samarium, and ytterbium at concentrations as low as 0.01 to 1 ppm. Hydrofluoric acid solutions of uranium containing the rare earth elements, with yttrium as an internal standard, were passed through a cation exchanger. The negatively charged uranium fluoride complex passed through the column while the rare earths were retained. After the residual uranium was completely removed by eluting with 2.5 M hydrofluoric acid, the resin bed was ignited, and the resulting ash analyzed spectrographically for the individual rare earth elements. Other cations which separate with the rare earths were easily separated by standard wet chemical group separations. The standard deviation for the method was about 10%. (auth)

13700

ASSAYING GRANULAR MATERIALS FOR WATER CONTENT BY MEANS OF NEUTRON MODERATION. K. Val'ter and M. L. Gol'din. Atomnaya Energ. 8, 248-50(1960) Mar. (In Russian)

The slow neutron flux was measured as a function of humidity in the tested materials. The experiments confirmed the feasibility of measuring the water content of granular material by neutron moderation. (R.V.J.)

13701

THE DETERMINATION OF URANIUM IN WATER WITH MORIN. E. Upor. Hidrol. Közlöny 38, 299-301(1958). Translated from Referat. Zhur. Khim. No. 16, 1959, abstract No. 56872).

Known methods for the determination of U in water and a method for the analysis of U in water by the use of morin are described. (auth)

13702

ANALYSIS OF BORON IN BOROSILICATE GLASSES BY NEUTRON TRANSMISSION. Peter R. Segatto (Corning Glass Works, N. Y.). J. Am. Ceram. Soc. 43, 278-81 (1960) May.

A rapid method for the determination of boron in borosilicate glasses by neutron transmission is developed. The glass sample is dissolved in 48% HF, placed in a polyethylene cell which is located near a Ra-Be neutron source. The neutron source and sample cell are embedded in a paraffin moderator. The attenuation of the neutron flux, which can be related to the boron concentration in the cell, is monitored with a BF_3, enriched B^{10} proportional counter. Boron determinations can be made in approximately 40 minutes with an accuracy of ±1%. Owing to the low sensitivity (approximately 1 mg) the major disadvantage of the method is the large sample size necessary. The method, however, is well suited for use as a quality control procedure. (auth)

13703

RADIOCHEMICAL DETERMINATION OF CESIUM BY COLORIMETRY OF DIPICRYLAMINE. A. M. Lefevre, J. F. Lefevre, and A. Raggenbass (Centre d'Etudes Nucléaires, Saclay, France). J. Inorg. & Nuclear Chem. 12, 297-303(1960) Feb.

Cesium is precipitated as dipicrylaminate which, after washing with ether, is dissolved in ethyl acetate. The Cs is then extracted from this solution by an aqueous acid solution. The ethyl acetate phase containing the dipicrylamine from decomposition of Cs dipicrylaminate is colorimetrically analyzed. The principal interest in this method lies in the possibility of radiochemical determination of carrier-free Cs by decontaminating the solution put in the spectrophotometer. (T.R.H.)

13704

A SOURCE OF ERROR IN THE DETERMINATION OF URANIUM-235 BY GAMMA-SPECTROMETRY. D. K. Cartwright and E. J. Robbins (United Kingdom Atomic Energy Authority, Chester, Eng.). J. Inorg. & Nuclear Chem. 12, 373-6(1960) Feb.

The background radiation at 184 kev, where U^{235} is usually measured, was found to be chiefly due to bremsstrahlung from Pa^{234} and to depend on the U^{238} concentration and the size, nature, and chemical history of the sample. The extent of this background is shown graphically for a uranium rod, uranyl nitrate crystals and solutions, various thicknesses of uranium metal samples, and a sample of U_3O_8. (D.L.C.)

13705

THE DETERMINATION OF XENON IN LIQUID BISMUTH. G. F. Hewitt, J. A. Lacey, and E. Lyall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy, Pt. B. Reactor Technol. 1, 167-72(1960) Mar.

A method for estimating the concentration of xenon in molten bismuth is described. A direct volumetric method and a technique employing gas thermal conductivity measurement were attempted and found unsatisfactory. A successful technique was developed involving the mass-spectrographic analysis of a hydrogen sample containing the xenon extracted from the bismuth, giving a sensitivity approaching 2×10^{-9} atom Xe per atom Bi. The method was applied to the determination of the solubility of xenon in bismuth at 500°C. It was found that the solubility is probably below the limit of sensitivity although there were some higher results. A radioactive technique was employed to demonstrate that the solubility was actually below 2×10^{-10} atomic fraction. The high degree of surface adsorption was demonstrated using an autoradiographic technique. (auth)

13706

SEPARATION OF RARE EARTH ELEMENTS. VII. STUDY OF THE SYSTEM OF PRASEODYMIUM OXIDE—NEODYMIUM OXIDE (DETERMINATION OF LABILE OXYGEN). Leopold Wolf, Gerhard Wolff, and Hartmut Baernighausen. J. prakt. Chem. 6, 259-65(1958). (Translated from Referat. Zhur. Khim. No. 10, 1959, abstract No. 34606).

In order to determine the labile O bonded to the higher oxide of Pr, a method consisting of the measurement of the volume of O_2 liberated from the reaction $4PrO_2 + 12H^+ \rightarrow 4Pr^{3+} + 6H_2O + O_2$ was employed. The Pr (4+) content in the mixture of Pr and Nd oxides may be calculated from the O_2 volume measurements. The oxides were dissolved in dil. HNO_3. The quantity of liberated O_2 was measured from the volume increase of the reaction space, confined by very pure mercury placed in a U-tube. One of the arms of the U-tube serves as a reading scale. The mixture of Pr and Nd oxides was heated for 12 hours at 800 to 1200°C prior to chemical analysis. After such a treatment, the PrO_2 content in the oxide mixtures, containing various proportions of the components, is an increasing function of the Nd_2O_3 content of the studied system. As a further check on the results of x-ray structure analysis, the above result indicates that Nd_2O_3 has a beneficial effect on the formation of PrO_2 in mixed crystals, with a fluorite type lattice. It is believed that Nd_2O_3 forms mixed crystals with Pr_6O_{11} as a result of the isomorphic substitution of Pr sesquioxide contained in its lattice. Displaced Pr_2O_3 is oxidized to PrO_2 by oxygen of the air. The content of labile oxygen in mixed fluorite type crystals depends to a large extent upon the conditions of the mixture's cooling subsequent to their heating. In mixtures with high Nd content, the phase correspondence and the amount of displaced O depend, in the main, on the conditions of roasting. In the latter case the basic component of the mixture is a hexagonal A-form of sesquioxides, which improves the mixed oxide's stability to action by the air's oxygen. (W.L.H.)

13707

ANALYTICAL CHEMISTRY OF THORIUM. I. HOMOGENEOUS PRECIPITATION OF THORIUM SELENITE AND SUBSEQUENT TITRIMETRIC DETERMINATION OF THORIUM. Jen-yin Yen, Kuang-hua Djao, and Feng-chiao Hsiao (Peking Univ.). Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, 195-9(1958). (Translated from Referat. Zhur. Khim. No. 7, 1959, abstract No. 23049).

The method of Th determination based on homogeneous precipitation of $Th(SeO_3)_2$ by hydrolytic neutralization of solutions containing $Th(NO_3)_4$, an excess of H_2SeO_3 (~0.014 M), and acetamide, dissolution of the precipitate in HCl, and titration of resulting solution with standard solution of $Na_2S_2O_3$ was studied. (W.L.H.)

13708

ABSORPTION SPECTRA OF RARE ELEMENT OXYQUINOLATES. II. PHOTOMETRIC DETERMINATION OF TITANIUM. I. P. Alimarin, A. P. Golovin, and I. V. Puzdrenkova. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 2, 185-8(1959). (In Russian)

A method was developed for photometrically determining titanium in the presence of cerium and other rare earth elements using 8-oxyquinoline. Berg's law is adapted to the colored oxiquinoline titanium solutions in the concentration range 0.005 to 0.100 mg. (R.V.J.)

13709

DIRECT COMPLEXOMETRIC DETERMINATION OF HEXAVALENT MOLYBDENUM. A. I. Busev and Fang Chang. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 2, 203-11(1959). (In Russian)

A direct titration of hexavalent molybdenum was achieved with complexon III solution at pH 4 to 5 (0.1% solution of pyrotehin + 0.1% indigo carmine indicator). Large quantities of strontium, potassium, and magnesium do not interfere. It is shown that molybdate interacts with complexon III at a ratio of 2:1. It is also shown that it is impossible to determine hexavalent molybdenum by titration of complexon III excess with zinc salt solution in the presence of xylenol orange as was previously suggested by J. Kinnuen and B. Wennerstrand. (R.V.J.)

13710
THE DETERMINATION OF RHENIUM AND OSMIUM IN IRON METEORITES BY NEUTRON ACTIVATION.
W. Herr, W. Hoffmeister, and J. Langhoff (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 15a, 99-102 (1960) Feb. (In German)

The trace elements rhenium and osmium were determined in ten iron meteorites by neutron activation. The distribution of both elements proved to be exceptionally homogeneous in the single meteorites. The osmium concentration was 1 to 3 ppm, but the concentration of the natural β emitter rhenium was only 0.2 ppm. A deviation from this value of about 2 powers of ten was established in Sichote-Alim meteorites. The average frequency in iron meteorites was $0.071/10^6$ Fe atoms for rhenium and $0.64/10^6$ Fe atoms for osmium. (tr-auth)

13711
OXYGEN ISOTOPE ANALYSIS OF THE RESPIRATORY AIR IN ANIMAL RESEARCH WITH APPLICATION OF THE MASS SPECTROMETER. G. Hübner, R. Ludewig, V. Görisch, and H. Birkenfeld (Deutsches Akademie der Wissenschaften, Leipzig and Karl-Marx-Universität, Leipzig). Z. Naturforsch. 15b, 128-31(1960) Feb. (In German)

In animal studies it was necessary to detect in the exhaled air the O_2 introduced in the blood stream in order to be able to recognize possible desiccation. Since radioactive oxygen isotopes with a half life long enough for the investigation do not exist, the stable oxygen isotope O^{18} was used for the labeling. The relative frequency of the stable isotopes O^{16} and O^{18} in the O_2 and CO_2 of the exhaled air was analyzed with a Nier-type mass spectrometer. The spatial separation of the research and measurement stations led to a number of methodic difficulties whose solutions are described. The results show that, if no mass spectrometer is available, work with stable oxygen isotopes is possible if the sampling is done with regard for certain precautionary measures. (tr-auth)

General Inorganic and Physical Chemistry

13712 GAT-290
Goodyear Atomic Corp., Portsmouth, Ohio.
A STUDY OF THE MILLER'S FLUORINATED LUBRICANT—CHLORINE TRIFLUORIDE REACTIONS. G. Stern and R. P. Bell. Jan. 15, 1960. 22p. Contract AT(33-2)-1. OTS.

The reactivity of Miller's Fluorinated Lubricant with chlorine trifluoride was investigated. Explosive reactions were obtained over a wide range of temperatures and pressures, one occurring at 115°C. The experimental conditions were made as reproducible as possible; however, statistical analysis shows no correlation between the variables and reactivity. The experimental techniques and instrumentation are described. (auth)

13713 GAT-T-796
Goodyear Atomic Corp., Portsmouth, Ohio.
A STUDY OF FREON DECOMPOSITION BY MOLECULAR SIEVES. F. A. Koehler. Apr. 19, 1960. 4p. Contract AT(33-2)-1. OTS.

A study was undertaken to determine the causes of overheated molecular sieve dryers used in the drying of Freon-22. The results indicate that a chemical reaction takes place between the Freon and the molecular sieves at elevated temperatures resulting in the decomposition of the Freon. Therefore, the feasibility of using molecular sieves to dry Freon under all conditions is questionable. (auth)

13714 NAA-SR-4924
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE FREE ENERGY, HEAT, AND ENTROPY OF FORMATION OF THORIUM TETRAFLUORIDE. A. J. Darnell. Feb. 15, 1960. 13p. Contract AT-11-1-GEN-8. OTS.

The equilibrium constant for the reaction, $ThF_4(s) + SiO_2(s) \rightleftharpoons ThO_2(s) + SiF_4(g)$ was determined over the temperature interval 871 to 1077°K by measuring the equilibrium pressure of SiF_4 above the system. The pressure of SiF_4 from this reaction is given by $\log P_{(atm)} = \{(-8200 \pm 120)/[T\ (°K)]\} + (7.740 \pm 0.130)$. A heat capacity correction of −2.76 cal/deg-mole gives, for the reaction at 298°K: $\Delta F^0 = 27.9$ kcal/mole, $\Delta H^0 = 39.4$ kcal/mole, and $\Delta S^0 = 38.7$ cal/deg-mole. From these calculations and previously published thermodynamic data for SiO_2, ThO_2, and SiF_4 the ΔF^0, ΔH^0, and ΔS^0 of formation of ThF_4 from the elements at 298°K were calculated to be −459.9 kcal/mole, −482.4 kcal/mole, and −75.8 cal/deg-mole, respectively. (auth)

13715 NP-8650
Midwest Research Inst., Kansas City, Mo.
THERMALLY STABLE SILICON-CONTAINING RESINS FOR DIELECTRIC APPLICATIONS. Quarterly Progress Report No. 1 [for] December 1, 1959—February 29, 1960. L. W. Breed and William J. Haggerty, Jr. Mar. 7, 1960. 18p. M.R.I. Project No. 2373-C. Contract AF33(616)-6916.

Dichelates formed from titanium esters and acetylacetone were found to undergo liquid-phase thermal decomposition at 130 to 170°C with the destruction of the chelate ring and the formation of an organic ester. Dichelates prepared from titanium esters and 8-quinolinol reacted with acetoxysilanes to yield near quantitative amounts of the expected organic ester. Hexamethyldisiloxane did not react with either bis(2-oxy-2-pentene-4-one) titanium oxide or isopropoxide. There is evidence that the isopropoxide and trimethylethoxysilane form a siloxytitane. The procedure of ester elimination for the formation of siloxanes appeared to be analogous to the well-known alkyl halide method. Considerable redistribution occured and only the siloxanes derived from the monofunctional silicon compounds present were obtained in good yields. p-Phenylenebis (diethoxymethylsilane) and glacial acetic acid did not give the siloxane polyol as previously reported. When other experimental monomers were hydrolyzed with aqueous hydrochloric acid, only p-phenylenebis (diethoxy-p-dimethylaminophenylsilane) showed significant carbon—silicon cleavage. (See also NP-8018.) (auth)

13716 TID-5734
Oklahoma State Univ., Stillwater. School of Mechanical Engineering.
AN INVESTIGATION OF A PARTICULAR COMPARATIVE METHOD OF SPECIFIC HEAT DETERMINATION IN THE TEMPERATURE RANGE OF 1500°F TO 2600°F. J. H. Boggs and J. A. Wiebelt. Feb. 1960. 96p. Project No. 6. Contract AT(11-1)-71. OTS.

A method of comparative calorimetry was developed for the determination of specific heat capacity. The method consists of placing the sample, which was previously sprayed with a magnesium oxide powder in methyl alcohol, in a crucible containing a thermocouple arrangement and then placing it in a high-temperature vacuum furnace. Test data are presented for tungsten, tantalum, synthetic sapphire, and molybdenum. (C.J.G.)

13717 TID-5738
Fordham Univ., New York.
PROGRESS REPORT. I. THE THERMODYNAMICS AND KINETICS OF COORDINATION COMPOUNDS. II. THE CHEMISTRY OF URANIUM SALTS IN SOLUTION. Michael Cefola and Philip S. Gentile. Mar. 1, 1960. 54p. Contract AT(30-1)-906. OTS.

A summary of research on the kinetics and thermodynamics of rapid reactions is given. Using a conductometric technique, the kinetics of Cu^{2+} with six diketones and substituted diketones were studied and data were obtained. These data establish the reversibility of the reactions, order of the reactions, heats and entropy of activation, reaction rates, and mechanisms for the reactions. Current studies using a modified apparatus are being conducted on Ni^{2+}—diketone systems. A spectrophotometric technique is also being used to evaluate the second rate constant k_2 for the reaction between Cu^{2+} and acetylacetone. Another method being investigated for obtaining thermodynamic data is by vapor pressure studies. Activities in this program are currently centered on preparation of high-purity salts such as those of nickel. Other research is reported on the chemistry of uranium in solution. Titrations of uranyl nitrate with sodium ethoxide were made in various non-aqueous solvents. Intermediate products from these reactions are being analyzed to clarify whether hydrogen uranates, diuranates, or polyuranates are obtained on addition of base to uranyl nitrate solutions. Preprints of published papers based on work supported by this contract since its inception are included along with abstracts of papers which were presented at A.C.S. meetings during the report period. (J.R.D.)

13718 Y-1279
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
AN EVALUATION OF URANIUM SALVAGE OPERATIONS—A CASE STUDY. A. E. Sands. Dec. 1, 1959. 71p. Contract W-7405-eng-26. OTS.

A study to develop ancillary methods for determining the costs of uranium salvage operations within the framework of an established accounting system is described. The experience obtained with different cost methods is examined. The technology employed in the recovery of uranium from salvage materials is also outlined. Shortcomings of the present cost method are discussed, and suggestions for further investigation are presented. (auth)

13719 AEC-tr-4043
CHEMICAL ADSORPTION ON IONIC CRYSTALS. F. F. Volkenstein. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Fiz. Khim. 26, 1463-71(1952). 16p. JCL.

Chemical adsorption of a monovalent atom A on an ionic crystal of the MR type (M = metal, R = metalloid) is considered, and the equations for bonding are derived for the special case of a space-centered parallelepiped as the crystal cell of the adsorbent. In the case of sufficiently large difference between the ionization potentials of A and M, adsorption cannot occur unless the free electron of the lattice (the conduction electron) is drawn into the action. If this electron is confined to the local level formed by the atom A approaching the lattice, a firm two-electron bond forms between A and the crystal, similar to that in the molecule H_2. (D.L.C.)

13720
CRYSTALLOGRAPHIC DATA: $ZrO_2 \cdot 3TeO$. R. P. Agarwala, E. Govindan, and M. C. Naik (Atomic Energy Establishment, Trombay, India). Anal. Chem. 32, 729 (1960) May.

A mixture of zirconium oxide and tellurium with a mole ratio of Zr/Te = 3 was heated for 48 hours in air at 750°C and then analyzed. A new compound, $ZrO_2 \cdot 3TeO$, was found, and data for its crystal structure from x-ray diffraction of the powder are given. (D.L.C.)

13721
MEASUREMENTS OF SATURATED BORON VAPOR PRESSURE. Yu. A. Priselkov, Yu. A. Sapozhnikov, and A. V. Tseplyaeva. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 134-7(1960) Jan.-Feb. (In Russian)

The saturated vapor pressure of boron (99.42% B with 0.16% hydrogen) at 1651 to 1764°K was determined by Knudsen effusion. The vapor pressure and heat of sublimation are tabulated. (R.V.J.)

13722
VAPORIZATION OF RARE-EARTH OXIDES. Patrick N. Walsh, Harold W. Goldstein, and David White (Ohio State Univ., Columbus). J. Am. Ceram. Soc. 43, 229-33(1960) May.

A study of the vaporization of La_2O_3, Nd_2O_3, and Y_2O_3 at high temperatures was carried out by the Knudsen effusion technique. The methods employed, the results of the measurements, and the low-temperature heat capacities of these materials, which were determined for the purpose of calculating thermal functions of the oxides, are discussed. All these oxides react with tantalum, forming gaseous tantalum monoxide as a principal product. Cubic tantalates of lanthanum and neodymium are also formed in these reactions. Dissociation energies of the monoxides of the rare-earth metals are given. Some generalizations about the vaporization behavior of the rare-earth oxides are discussed. (auth)

13723
ON THE REACTIVITY OF URANOURANIC OXIDE. [PART] II. ON THE REACTIVITY OF URANOURANIC OXIDES PREPARED BY THERMAL DECOMPOSITION OF URANYL NITRATE, AMMONIUM DIURANATE AND URANIUM PEROXIDE. R. Ukazi (Osaka Metal Ind. Co.). J. Atomic Energy Soc. Japan 2, 117-21(1960) Mar. (In Japanese)

The rates of reduction, hydrofluorination, fluorination, and oxidation were measured for uranium oxides, U_3O_8 I, II, and III, prepared by thermal decomposition of uranyl nitrate, ammonium diuranate and uranium peroxide, respectively. In these reactions, III was always the most reactive, II was next, and I was least. It is found that the rate of reduction of U_3O_8 with hydrogen can be expressed by $(1 - c)^{1/3} = 1 - kt$, where c is the molar fraction of uranous oxide, t is the reaction time, and k is the velocity constant. The constant k is the best measure for the reactivity of U_3O_8. The presence of nitrogen less than 0.05 wt. % and other impurities such as iron, nickel, silicon, and thorium in the oxide did not change the value of k appreciably. (auth)

13724
PARTICLE SIZE DISTRIBUTION ANALYSIS OF THORIUM OXIDE BY NEUTRON ACTIVATION AND RI LABELING. T. Takeda, I. Suzuki, and K. Kimura (Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 122-6(1960) Mar. (In Japanese)

A gravity sedimentation method similar to the Andreasen pipette method is used for determining the particle size distribution of thorium oxide. The Andreasen Pipette Method for the accumulative percentage of the particles is replaced with a γ-ray counting method. The sample material was activated by irradiation in JRR-1 or labeled with radioactive thorium-234 (UX_1). In both cases, the particle size distribution in the range of 0.3 to 70μ was determined. The principle and application of the method are described. (auth)

13725

MECHANICS OF ATOMIC RECOMBINATION REACTIONS Don L. Bunker (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 32, 1001-5(1960) Apr.

A treatment is developed for calculating the formation constant for a collision complex from a pair of chemically interacting atoms. For iodine atoms, this leads to a value of the rate constant for $I + I + M \rightarrow I_2 + M$, if the mechanism is $2I \rightleftharpoons I_2^*(^1\Sigma)$, $I_2^* + M \rightarrow I_2 + M$. The rate constant so calculated agrees with that obtained by a statistical procedure. The calculation also furnishes enough information about the collisions so that the contribution of molecular states other than $^1\Sigma$ to recombination may be deduced. As a result a conclusive discussion is given of the plausibility of the suggested mechanisms. (auth)

13726

LIGAND-FIELD THEORY OF LINEAR GASEOUS MOLECULES INVOLVING THE FIRST TRANSITION SERIES ELEMENTS. Robert A. Berg and Oktay Sinanoglu (Univ. of California, Berkeley). J. Chem. Phys. 32, 1082-7 (1960) Apr.

Although the various high symmetry compounds of the "iron-group" elements, e.g., the solid oxides, hydrated complexes, etc., are sufficiently understood in terms of the present ligand-field theory, no semiquantitative schemes have been utilized to understand and predict the spectroscopic and thermal properties of their gaseous molecules. The observed dissociation energy vs atomic number curves for the linear gaseous oxides and halides of the first transition series are compared with the corresponding energy curves of the solids and the similarities are pointed out. It is shown that the double maximum stabilization curves observed in the gaseous molecules as well can be understood in terms of the splitting of the (3d) shell of the transition atoms in a linear ($C_{\infty v}$ or $D_{\infty h}$ symmetry) ligand field with two independent splitting parameters, one of which is small. A method for predicting the low-lying molecular spectral states is developed. The energies of the states depend on the splitting parameters and the electron interactions. The parameters are estimated from the first portion of the thermal data and used only for these elements. The electron interaction energy is obtained from the spectral terms of free atoms (ions). Unlike the case in the high symmetry applications, this procedure takes into account "electronic correlation" (configuration interaction) effects. The generality of the treatment is revealed by comparing the results of the simple ionic and covalent models with those of the molecular orbital method. Calculations of spectral states are made for ScO, TiO, VO, and CrO, and experimental data are discussed. (auth)

13727

ELECTRONIC ENERGY LEVELS AND CRYSTAL QUANTUM STATES OF Tm(IV). John B. Gruber and John G. Conway (Univ. of California, Berkeley). J. Chem. Phys. 32, 1178-82(1960) Apr.

Limited agreement is obtained between theory and experiment for 4f → 4f transitions for Tm(IV) ($4f^{12}$). Intermediate coupling is important in the case of Tm (IV). Solutions of the intermediate field equations yield $\zeta_{4f} = 2700$ cm^{-1}, $F_2 = 450$ cm^{-1}, and $\chi = (\zeta/F_2) = 3$. Experimental agreement to ±200 cm^{-1} is obtained. (auth)

13728

APPLICATION OF A HIGH-SPEED ELECTRONIC COMPUTER IN DIFFUSION KINETICS. II. DEPLETION EFFECT IN THE SPHERICAL ONE-RADICAL ONE-SOLUTE MODEL. Hugo Fricke and David L. Phillips (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 1183-4(1960) Apr.

Earlier computations on diffusion in the spherical one-radical one-solute model were extended by taking account of the transient dilution of the solute which occurs during the reaction. Although the drop in concentration of the solute near the center of the reaction zone may be considerable, its effect on the fraction of radicals combining with the solute is only of the order of one percent under the most unfavorable conditions likely to be encountered when the model is applied to γ-irradiated aqueous solutions. (auth)

13729

EXCHANGE OF RADIOCHLORINE BETWEEN HYDROGEN CHLORIDE AND CARBON TETRACHLORIDE. "RED FORM" OF SOLID HYDROGEN CHLORIDE. Irving M. Pearson and Clifford S. Garner (Univ. of California, Los Angeles). J. Chem. Phys. 32, 1214-17(1960) Apr.

Chlorine-36 was used to investigate the HCl^*-CCl_4 exchange in systems of high purity at 22 to 35°C in the dark and in sunlight for exchange times up to 200 and 117 days, respectively, with solutions 0.14 to 0.18$\underline{F}$ in HCl and 10$\underline{F}$ in CCl_4. The exchange rate law is not known, but results are presented in terms of an assumed bimolecular rate law, $R = k(HCl)(CCl_4)$. For the dark $k \leq 2 \times 10^{-11}$ liter mole^{-1} sec^{-1}, an upper limit which is about 4×10^7 times smaller than the upper limit set by earlier workers. There is no evidence that the exchange is accelerated in sunlight. The so-called "red form" of solid HCl was observed during the work, as well as yellow solid HCl. An apparent red-inducing impurity was found separable from most of the HCl by slow vacuum distillation of the latter from a −140°C bath to a trap at −196°C. The solid HCl distillate was colorless and failed to develop a red color even in six flash freezings at −196°C, whereas the pale yellow HCl residue from the distillation gave a rose-red color on being flash frozen at −196°C. Volatility characteristics of the latter apparent impurity suggest that, if it be an oxide of nitrogen as proposed by Clusius and Haimerl, it is probably not NO but rather N_2O or possibly N_2O_3. If the red color arises from imperfection color centers in the crystal lattice of HCl, as suggested by Johnston and Martin, generation of the color seems to require both reasonably rapid freezing at or near −196°C and the presence of an impurity separable from the HCl by a proper distillation. Consequently the flash-freeze test for traces of HCl in other substances must be interpreted with caution. (auth)

13730

PARAMAGNETIC RESONANCE IN TETRAVALENT Pa^{231}. John D. Axe, Ru-tao Kyi, and H. J. Stapleton (Univ. of California, Berkeley). J. Chem. Phys. 32, 1261(1960) Apr..

The paramagnetic resonance spectrum of tetravalent Pa^{231} was observed in a single crystal of Cs_2ZrCl_6 doped with $PaCl_4$. At 4.2°K and a frequency of 9457 Mcps, the resonance pattern consists of four widely separated hyperfine components and is isotropic; no resonance was detected at 77°K. Interpretations in terms of transitions between spin eigenstates are given. The paramagnetism is ascribed to a single 5f electron. (D.L.C.)

13731

INTERMOLECULAR ISOTOPE EFFECT IN RECOIL TRITIUM REACTIONS WITH HYDROGEN. J. K. Lee, Burdon

Musgrave, and F. S. Rowland (Univ. of Kansas, Lawrence). J. Chem. Phys. 32, 1266-7(1960) Apr.

The intermolecular isotope effect in recoil tritium reactions with hydrogen and deuterium was studied by sealing off gas mixtures of He^3 with H_2 and D_2 and irradiating with a thermal neutron beam for two days, the reaction being He^3(n,p)T. The products were then separated by gas chromatography, and their radioactivity was measured. In this way, HT/DT ratios were measured for various H/D ratios, and T is found to have a strong preference for HT formation over DT; the isotope preference is 1.55 ± 0.06. With NO or O_2 added as a free radical scavenger, the preference is higher. (D.L.C.)

13732

CLOSED CRUCIBLE—A NEW TECHNIQUE IN HIGH TEMPERATURE CHEMISTRY. ITS APPLICATION TO TANTALUM AND MOLYBDENUM OXIDES. E. David Cater, Ernest R. Plante, and Paul W. Gilles (Univ. of Kansas, Lawrence). J. Chem. Phys. 32, 1269-70(1960) Apr.

A new technique involving the use of closed crucibles is developed for the characterization of vaporizing systems and some of its possible uses are pointed out. In particular, the use of such crucibles would facilitate the detection of any reaction of the sample with the crucible or diffusion through the crucible, and an estimate of the diffusion coefficients through the crucible or the composition of any escaping gases could be made. At 2172°C, Ta_2O_5 in a closed Ta crucible was found to lose O_2 through the crucible wall. The ratio O/Ta for the transported matter was found to be 1.60, giving $TaO_2/TaO = 1.50$, which is in fair agreement with that given by extrapolation from other data. Experiments with MoO_2 in a closed Mo crucible show that a lid cooler than the crucible gains weight because of MoO_2 deposition, but that a hotter lid loses weight because of the reaction, $2MoO_3(g) + Mo(s) = 3MoO_2(g)$, occuring on the lid. The direction of the transport indicates that the reaction is endothermic. (D.L.C.)

13733

THE USE OF ELECTRICAL CONDUCTIVITY DATA WITH JOB'S METHOD. J. F. Tate and M. M. Jones (Vanderbilt Univ., Nashville). J. Inorg. & Nuclear Chem. 12, 241-51(1960) Feb.

Electrical conductivity has been applied with Job's method but this application led to results which are often at variance with the results of studies using other properties or other methods. In order to find the source of this discord, a thorough theoretical and experimental analysis of this particular procedure was performed. Electrical conductivity is concluded to be an unsuitable property for Job's method. (auth)

13734

THERMAL DECOMPOSITION OF THE HEAVIER RARE-EARTH METAL NITRATE HYDRATES. THERMOBALANCE AND DIFFERENTIAL THERMAL ANALYSIS STUDIES. W. W. Wendlandt and J. L. Bear (Texas Technological Coll., Lubbock, Tex.). J. Inorg. & Nuclear Chem. 12, 276-80(1960) Feb.

The thermal decomposition of europium, gadolinium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium nitrate 4-hydrates was studied by means of the thermobalance and differential thermal analysis (DTA). The compounds were classified into three groups on the basis of their thermal decomposition patterns: Group A—europium, gadolinium, and dysprosium; group B—holmium, erbium, and thulium; and group C—ytterbium and lutetium. The DTA endotherms agreed fairly well with the corresponding decomposition reactions found on the weight-loss curves. (auth)

13735

CONTACT ANGLES BETWEEN LIQUID BISMUTH AND PURE IRON AND MILD STEEL. A STUDY OF INTERFACIAL REACTIONS. D. H. Kerridge and S. D. Ford (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy, Pt. B. Reactor Technol. 1, 153-60(1960) Mar.

The receding and advancing contact angles between liquid bismuth and pure iron and mild steel were measured and the change of contact angle with time at a series of temperatures has been determined. Two chemical reactions were found to take place at the solid-liquid interface. The first is thought to be the reaction of chloride ions (present as bismuth oxychloride impurity in the solution) with the iron surface; the second the reduction of bismuthyl ions by the iron. The first process has an activation energy of 30 kcal and the second process an activation energy of 15 kcal. (auth)

13736

APPLICATION OF GIBBS AND GIBBS-DUHEM EQUATIONS TO TERNARY AND MULTICOMPONENT SYSTEMS. Nev A. Gokcen (Univ. of Pennsylvania, Philadelphia). J. Phys. Chem. 64, 401-6(1960) Apr.

A simple method of application of the Gibbs equation for the calculation of partial molar properties of components in ternary and multicomponent systems from the known partial molar property of one component is presented. It is also shown that Wagner's, McKay's and Schuhmann's equations for the calculation of thermodynamic properties of ternary systems may be rederived in a systematic and concise manner either from the Gibbs free energy function or the Gibbs-Duhem equation, and that Wagner's and Schuhmann's methods consist of the integration of the same cross differential equation along the same path. These methods are extended to multicomponent systems. (auth)

13737

KINETICS OF $NOUF_6$ HYDROLYSIS IN AIR. F. E. Massoth, L. R. Swaney, and W. E. Hensel, Jr. (Goodyear Atomic Corp., Portsmouth, Ohio). J. Phys. Chem. 64, 414-17(1960) Apr.

The kinetics of $NOUF_6$ hydrolysis in air were determined from 68 to 231°C. The results indicate that the hydrolysis reaction follows parabolic kinetics throughout. Variation of the rate constants with temperature showed an Arrhenius dependency when corrected for increasing concentration of hydrated water at lower temperatures. The activation energy for the diffusion process was determined to be 10.9 kcal per mole of $NOUF_6$. (auth)

13738

THE PREPARATION AND IDENTIFICATION OF SOME INTERMETALLIC COMPOUNDS OF POLONIUM. W. G. Witteman, A. L. Giorgi, and D. T. Vier (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 64, 434-40 (1960) Apr.

A micro technique for the preparation of intermetallic polonium compounds is described. Several polonides of the form MPo were prepared in this way and investigated by x-ray-powder diffraction; they include those of Be, Mg, Ca, Sr, Ba, Zn, Cd, Hg, and Pb. All these polonides, with the exception of Mg and Hg, were found to be isomorphous with the corresponding compounds of S, Se, and Te. X-ray-diffraction and crystal structure data are given. Reactions of Po with Ni, Cu, Ag, Au, C, Mo, Ta, and W are also described. (D.L.C.)

13739

EXCHANGE OF RADIOCHLORINE BETWEEN MOLECULAR CHLORINE AND CARBON TETRACHLORIDE. Irving M.

Pearson and Clifford S. Garner (Univ. of California, Los Angeles). J. Phys. Chem. 64, 501-3(1960) Apr.

The exchange of Cl^{36} between labeled Cl_2 and CCl_4 is studied both in the dark and in sunlight over long periods of time (up to 211 days) and with high Cl_2 concentrations. Rate constants for $^3/_2$- and second-order reactions are calculated from the data, but the exchange rate law is not established. The possibility of stopcock grease interfering in the exchange studies is investigated and discussed in some detail. It is concluded that the very small exchange rates found in the Cl_2—CCl_4 system would be of negligible significance in exchanges in Cl_2—anhydrous chloride systems with CCl_4 as solvent. (D.L.C.)

13740

THE SYSTEM LITHIUM HYDRIDE—LITHIUM FLUORIDE. Charles E. Messer and John Mellor (Tufts Univ., Melford, Mass.). J. Phys. Chem. 64, 503-5(1960) Apr.

The lithium hydride—lithium fluoride system was investigated by thermal analysis and x-ray crystallography in order to study solid solution formation up to the melting point. Thermal analysis data plotted in the form of a solid-liquid phase diagram indicate that solid solutions form in all proportions at the melting points of these solutions. X-ray crystallography converted into lattice constants and plotted versus temperature showed two constants up to 321°C and only one constant thereafter. It is concluded that lithium hydride and lithium fluoride are completely soluble in each other at their melting points and that a critical solution temperature for the solid solutions may exist between 295 and 321°C. (D.L.C.)

13741

DENSITIES OF SOLID SALTS AT ELEVATED TEMPERATURES AND MOLAR VOLUME CHANGE ON FUSION. J. O'M. Bockris, A. Pilla, and J. L. Barton (Univ. of Pennsylvania, Philadelphia). J. Phys. Chem. 64, 507-10 (1960) Apr.

Knowledge of the volume change on fusion and the densities of the solid salts is necessary for the evaluation of structural models for the liquid salts. A high-temperature gas densitometer is used to measure the expansion of a solid salt from room temperature to just below its melting point. The molar volume change on fusion can also be obtained and is expressed as percentage of the solid molar volume. The results are: density for KCl is $\rho = (1.985 - 5.459 \times 10^{-5}t - 1.836 \times 10^{-7}t^2) \pm 0.001$ g/cm^3; for NaCl, $\rho = (2.168 - 1.267 \times 10^{-4}t - 1.754 \times 10^{-7}t^2) \pm 0.002$ g/cm^3, where t is the temperature in °C. The volume change as percentage for KCl is 20.20 ± 0.05%; for NaCl, 25.58 ± 0.07%. (D.L.C.)

13742

THE SECOND VIRIAL COEFFICIENT OF ORTHO AND PARA HYDROGEN AT LIQUID HYDROGEN TEMPERATURES. J. J. M. Beenakker, F. H. Varekamp, and H. F. P. Knaap (Kamerlingh Onnes Laboratorium, Leiden). Physica 26, 43-51(1960) Jan. (In English)

A method is described for measuring the difference in the second virial coefficient of the equation of state between the ortho and para modifications of H_2 and D_2 with a sensitivity of the order of 3×10^{-6} amagat, corresponding to a relative change in the virial coefficient of H_2 of the order of 5×10^{-4}. A difference of about 1% in the virial coefficient was found for para and normal H_2, the normal H_2 having the larger absolute value. The change appeared to be linear in the concentration. No measurable effect was found in the case of D_2. (auth)

13743

HYDRIDES OF RARE-EARTH METALS. V. I. Mikheeva and M. E. Kost. Uspekhi Khimii 29, 55-73(1960) Jan. (In Russian)

Data are included from studies of the chemical bonds between lanthanum and hydrogen and cerium and hydrogen, kinetics of cerium hydridation, chemical and physical structure and dissociation pressure of cerium hydrides, and the properties of praseodymium, neodymium, samarium, europium, gadolinium, and ytterbium hydrides. (R.V.J.)

13744

PERIODATE COMPLEX COMPOUNDS OF RARE-EARTH ELEMENTS. I. P. Alimarin and I. V. Puzdrenkova. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 2, 213-16(1959). (In Russian)

Preparations of periodate complexes of lanthanum, praseodymium, erbium, and thorium with caustic potash are described. Potassium periodate oxidized trivalent cerium to tetravalent cerium. Cerium and other rare earth complex anions were determined by ion exchange. It is shown that lithium salts of periodate cerium and lanthanum complexes have unstable compositions as lithium periodate is extracted simultaneously. (R.V.J.)

13745

ON THE STATE OF ZIRCONIUM IN MINERAL ACID SOLUTIONS. T. A. Belyavskay and Ping-Wên. Mu. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 4, 207-14(1959). (In Russian)

Sorption of various concentrations of zirconium from hydrochloric, perchloric, nitric, and sulfuric acid solutions by ion exchangers KU-2, DE-10P, and AB-17 was studied. Correlations were made of the data on sorption and zirconium solution electrophoresis on paper. The state of zirconium in mineral acid solutions is postulated. (R.V.J.)

13746

DIFFUSION IN MOLTEN SULFIDES. L. Yang, S. Kado, and G. Derge. p.79-80 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

The self-diffusion of iron in molten FeS and FeS—Cu_2S was investigated. Results are given for 29, 31, and 33.5% S in the FeS systems and 75—25 and 50—50% respectively in the FeS—Cu_2S systems. It is noted from the results that the self-diffusion of iron increases qualitatively as the activity. (B.O.G.)

13747

LA CHIMIE DES HAUTES TEMPÉRATURES. SECOND COLLOQUE NATIONAL, PARIS, 28 NOVEMBRE 1957. (High Temperature Chemistry. Second National Conference, Paris, November 28, 1957). Paris, Centre National de la Recherche Scientifique, 1959. 178p. 20 NF.

The papers presented at the Second National Conference on High Temperature Chemistry are published. Separate abstracts have been prepared on nine of the papers. (J.S.R.)

13748

THERMAL DECOMPOSITION REACTIONS OF URANYL SELENITES AND SODIUM URANYL SELENITES. R. Claude (Faculté des Sciences, Caen, France). p.147-52 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

The uranyl selenites and sodium uranyl selenites are decomposed by heating to a temperature characteristic of each with release of selenium dioxide. The weight losses are observed by graphic recording with the Chevenard thermobalance. The heating rate is 150°/hr. Uranyl selenite UO_2SeO_3, uranyl acid selenite $UO_2(SeO_3H)_2 \cdot H_2O$, sodium uranyl selenite B $Na_2\ U_2O_4(SeO_3)_3$, and sodium uranyl selenite A $Na_2UO_2(SeO_3)_2$ were prepared and their thermal decomposition reactions determined. The decomposition curves are given. (J.S.R.)

Radiation Chemistry and Radiochemistry

13749 BNL-574
Brookhaven National Lab., Upton, N. Y.
INDUSTRIAL CHEMICAL PRODUCTION BY CHEMO-NUCLEAR PROCESSES WITH SPECIAL REFERENCE TO THE PRODUCTION OF FIXED NITROGEN. G. Lellouche and M. Steinberg. Sept. 1959. 65p. OTS.

The characteristics and feasibility of the direct use of nuclear reactors for production of industrial chemicals were examined. The investigation was limited to endothermic chemical reactions utilizing fission fragment energy, and further limited to the gas phase. The program was conducted to determine if chemo-nuclear processes are feasible and competitive and to indicate areas of research activity required for further development. The reaction forming oxides of nitrogen was selected for the study, and data correlations and evaluations, chemical thermodynamics, radiation kinetics, reactor parameter studies, chemical process design studies, chemical economics, radioactivity and contamination studies, power plant design, and cost estimates related to production processes are included. (J.R.D.)

13750
ELECTRON SPIN RESONANCE STUDIES OF THE RADIATION-INDUCED ADDITION OF HBr TO C_2H_4 IN THE SOLID STATE. F. W. Mitchell, B. C. Green, and J. W. T. Spinks (Univ of Saskatchewan, Saskatoon, Can.). Can. J. Chem. 38, 689-96(1960) May.

Electron spin resonance measurements at 77°K were used to study the hydrobromination of ethylene induced by γ irradiation of the solid mixture at liquid nitrogen temperatures. The evidence resulting from these studies gave valuable information regarding the reaction intermediates and was used in formulating a likely reaction mechanism. (auth)

13751
RADIOCHEMICAL RESEARCH IN THE U.S.S.R. Victor Spitsyn (Moscow Univ.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 1-13(1959).

A review of radiochemical research progress in U.S.S.R. beginning with 1900 is presented. Among the topics covered are coprecipitation, adsorption, colloidal behavior, nuclear isomers, chemistry of individual radioelements, especially U and Th, and analytical methods. A bibliography of 83 references is included. (D.L.C.)

13752
EFFECT OF GAMMA RADIATION INTENSITY ON THE POLYMERIZATION OF ETHYLENE. B. G. Bray, R. A. Carstens, O. A. Larson, J. J. Martin, and K. K. G. Sikchi (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 33-41(1959).

The effects of gamma irradiation intensity on the initiation of polymerization of ethylene gas were investigated. A series of runs was made at relatively constant temperature and pressure (18 to 24°C and 770 to 890 psig), while radiation intensity was varied from 60 to 500 krep/hr. The length of reaction time varied from 3.1 to 96.0 hours. The first order approximation reaction constant as a function of radiation intensity under these conditions is $k = 4.5 \times 10^{-5}\ I^{0.7}\ hr^{-1}$. A second series of runs was made varying temperature and pressure (8 to 210°C and 950 to 4300 psig) and keeping the intensity relatively constant at 17.5 to 54.0 krep/hr. The reaction rate was found to increase with pressure, but dependence on temperature was not apparent. Water or cyclohexane was added to some of these runs; no effect on the rate was observed. The rate of ethylene disappearance is proportional to the first power of intensity as time approaches zero, and to the square root at infinite time. A number of reaction mechanisms was considered and a two-step process with radiation as reactant in both steps is selected as best fitting the data. Some inhibition is indicated, and evidence for oxygen being one of the inhibiting agents is presented. (D.L.C.)

13753
KINETICS OF THE RADIOCHLORINATION OF PROPIONIC ACID IN SOLUTION IN CARBON TETRACHLORIDE. Philippe Traynard and Pierre Verrier (Centre d'Études Nucléaires, Grenoble, France). Compt. rend. 250, 2570-72(1960) Apr. 4. (In French)

The radiochemical chlorination of organic acid develops by chain reaction. A study was made of a mixture of propionic acid and carbon tetrachloride exposed to x radiation. The chlorine is dissolved in the liquid. The isomeric distribution of the substituted chlorine is 30% in the α position and 70% in the β position. The kinetic mechanism at the beginning of the reaction was determined. The chlorination of pure acid occurs with a velocity proportional to the square root of the dose intensity, but for diluted solutions the chlorination is proportional to the dose intensity. The chlorine concentration of concentrated solution is represented by an exponential law as a function of the length of irradiation. For very dilute solutions the initial reaction occurs on the tetrachloride. The energy of activation of the chain reaction was determined to be $E_p = 15.7$ cal/mole. (J.S.R.)

13754
DIRECT RADIOSYNTHESIS OF SOME DYES. Jean Loiseleur and Michelle Petit. Compt. rend. 250, 3573-5 (1960) Apr. 4. (In French)

According to the molecular weight of the irradiated molecule, ultraviolet and x radiations cause either radiolysis or synthesis. A direct method for the radiosynthesis of dyes is proposed. The method combines the simultaneous effects of radiation and heat. Studies made on the synthesis of various dyes show that the radiosynthetic yield increases with the length of irradiation and with increased temperature. (J.S.R.)

13755
RADIATION-CHEMICAL ISOMERIZATION OF BENZENE. I. V. Vereshchinskii (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 12, 2234-5(1959) Dec. (In Russian)

Carbon-fulvene (5-methylenecyclopentadiene) is formed in electron bombardment of argon-saturated liquid benzene. The radiochemical yield of fulvene was 0.76 to 0.85 molecules/100 ev. (R.V.J.)

13756
RADIOLYTIC OXIDATION YIELD OF FERROUS IONS AT HIGH DOSE RATES. A. K. Pikaev and P. Ya. Glazunov (Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 12, 2244-5 (1959) Dec. (In Russian)

A method was developed for producing and measuring single monoelectric pulses of accelerated electrons generated in an acceleration tube. The method was applied in an analysis of Fe^{2+} radio-oxidation. The magnitude of $G(Fe^{3+})$ at 10^{12} ev/ml/sec does not differ greatly from $G(Fe^{3+})$ at smaller dosage. (R.V.J.)

13757

MASS SPECTROMETRIC STUDIES OF IONIC INTERMEDIATES IN THE ALPHA-PARTICLE RADIOLYSIS OF ETHYLENE. C. E. Melton and P. S. Rudolph (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 32, 1128-31(1960) Apr.

Two techniques were used for the elucidation of ion-molecule reaction mechanisms in the alpha radiolysis of C_2H_4 in the new alpha-particle mass spectrometer. The corresponding variations in the percent of primary, secondary, and tertiary ions over a tenfold pressure range (to 0.1 mm) were used to postulate the reaction mechanisms. Mixtures of the C_2 hydrocarbons were employed to increase the relative concentrations of a specific reactant ion, confirming the postulated mechanisms. Polymeric ions as large as $C_5H_9^+$ were observed. Conclusions as to reaction mechanisms drawn from this study are compared to those drawn from the appearance potential technique used in the electron impact studies. Values of the rate constants are also compared for several secondary reactions. (auth)

13758

DISSOCIATION OF C_6H_5T FOLLOWING BETA DECAY. Thomas A. Carlson (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 32, 1234-9(1960) Apr.

The relative abundance of the various charged fragments formed following beta decay of monotritiated benzene was measured with a specially designed mass spectrometer. In nearly every case the C—He bond was ruptured, the charge remaining with $C_6H_5^+$. In 28% of the events the $C_6H_5^+$ species were further excited to produce more than 30 different charged fragments. Comparison of the spectra with the electron impact data on benzene is made to arrive at an estimate of the energies involved in the initial excitation and the results are found to be in essential agreement with those of other tritiated hydrocarbons. The molecular excitation of benzene following beta decay is then shown to result probably from a sudden electronic perturbation following the formation of the doubly charged He^3 nucleus. Some results on the dependence of the collection efficiency of a given ion on its kinetic energy are also discussed. (auth)

13759

OBSERVATIONS OF THE THERMAL BEHAVIOR OF RADICALS IN GAMMA-IRRADIATED ICE. Seymour Siegel, Lillian H. Baum, Sol Skolnik, and John M. Flournoy (Aerojet-General Corp., Azusa, Calif.). J. Chem Phys. 32, 1249-56(1960) Apr.

Ice was subjected to γ radiation at 77°K and the EPR spectra of the radicals produced were examined as a function of temperature. The spectrum consisted of a doublet centered at $g = 2.008 \pm 0.002$ and split by 40 gauss; the corresponding spectrum of irradiated D_2O consisted of a triplet with approximately 6 gauss between adjacent lines. The doublet decayed rapidly above 100°K leaving a residual broad line which was thermally stable until approximately 145°K. The main spectrum is attributed to the OH radical and the residual line assigned to the HO_2 radical. The decay process of the OH radicals was shown to follow the rate law $d(OH)/dt = -k(OH)^{3/2}$ where $k = 8.5 \times 10^{12} \exp{-6000/RT}$ $(liter/mole)^{1/2}$ sec^{-1}. The magnitude of the rate constant was shown to be a function of the total irradiation damage experienced by the ice sample. Stabilization of OH radicals at 77°K was studied as a function of total irradiation dosage; saturation is reached at an OH concentration of 1.8×10^{-3}M or 0.003 mole %. The EPR spectrum of a frozen aqueous NO solution was also observed; it consisted of a broad line centered at approximately $g = 2.08$. (auth)

13760

THE MERCURY-SENSITIZED RADIOLYSIS AND PHOTOLYSIS OF METHANE. Gilbert J. Mains and Amos S. Newton (Univ. of California, Berkeley). J. Phys. Chem. 64, 511-12(1960) Apr.

The radiolysis of methane with and without mercury was investigated at 260°C, using a 4.5-Mev electron beam, and the gas was then analyzed for its hydrocarbon content. Mercury-sensitized photolysis of methane at 260°C was also investigated for comparison. A table of product yields of hydrogen and hydrocarbons is given for both experiments. Mercury was found to accelerate the radiolysis. Photolysis products were found to exhibit a somewhat higher yield of neopentane and other higher hydrocarbons, but otherwise they are quite similar to those of radiolysis. The data support reactions like $CH_4 + Hg(^3P_1) \rightarrow CH_3 + H + Hg$ for the mercury-sensitized radiolysis and a free radical mechanism for the photolysis. (D.L.C.)

13761

A COMPARISON OF SOME PHYSICAL PROPERTIES OF POLYETHYLENE-STYRENE GRAFT COPOLYMERS PREPARED BY THE TRAPPED FREE RADICAL METHOD AND POLYETHYLENE-POLYSTYRENE BLENDS. Leigh C. Anderson, Don A. Roper, and James K. Rieke (Univ. of Michigan, Ann Arbor and Dow Chemical Co., Midland, Mich.). J. Polymer Sci. 43, 423-6(1960) Apr.

The preparation and properties of polyethylene-styrene graft copolymers using trapped free radicals produced in polyethylene by gamma rays are reported. When polystyrene branches are attached to the polyethylene chain there is reinforcement of the mechanical strength of polyethylene, whereas the corresponding physical blend of polystyrene and polyethylene has lowered strength. (auth)

13762

TWO DIFFERENT POLYMERIZATION MECHANISMS OF ACRYLONITRILE INITIATED BY γ-IRRADIATION. Hiroshi Sobue and Yoneho Tabata (Univ. of Tokyo). J. Polymer Sci. 43, 459-65(1960) Apr.

The polymerization of acrylonitrile induced by ionizing radiation was investigated in bulk in the temperature range 15 to −196°C. It was found that two different mechanisms could exist in the polymerization under the same conditions in different temperature regions. The two polymerization phenomena at room and at very low temperatures were studied from the point of view of radical and ionic polymerization mechanisms. In solid state polymerization at very low temperatures the following results were obtained: first, the activation energy is very low, i.e., ca. 0.4 kcal/mole; second, an induction period was not observed under various conditions; third, the monomer containing a radical scavenger was easily polymerized. The described facts indicate that polymerization in the solid state should proceed by an ionic mechanism. (auth)

13763

CROSSLINKING OF POLYVINYL CHLORIDE BY IONIZING RADIATION. Zenichiro Kuri, Hisashi Ueda, Shoji Shida, and Kenichi Shinohara (Tokyo Labs., Japanese Assn. for Radiation Research on Polymers). J. Polymer Sci. 43, 570-2(1960) Apr.

The effects of gamma radiation on the crosslinking of polyvinyl chloride were studied by measuring the gel fraction in tetrahydrofuran as solvent. After irradiation, the powdered samples were subjected to the following treatments: (1) no treatment, (2) heating at 100°C for 10 minutes in vacuum, (3) exposing to air before heating and then heating in air or vacuum, and (4) swelling in tetrahydrofuran or cyclohexane in vacuum. In (1) and (3), no gelation was observed; in (2) and (4), the amount of gelation was found to be proportional to the dose. Electron spin resonance experiments were also performed with the irradiated solid samples, and they indicate that radicals formed by irradiation show little decay at room temperature, but show second-order decay rate at higher temperatures. The above results imply that the differences among reported data for the effects of radiation on polyvinyl chloride may be due to differences in experimental conditions. A mechanism for the crosslinking reaction is proposed. (D.L.C.)

13764

CHANGES IN PROPERTIES OF HIGH POLYMER SOLUTIONS BY RADIATION. Shintaro Sugai. Kōbunshi 8, 513-18(1959) Sept. (In Japanese)

Experimental results as well as theoretical considerations are included. The effects of radiation on the properties of aqueous and nonaqueous polymer solutions with respect to the decomposition of a polymer in a dilute solution, the direct and indirect effects, and the aftereffect were investigated. Changes in viscosity, concentration of dissolved oxygen in the solution, molecular decomposition, molecular and electrical properties in an aqueous polymer solution after irradiation are discussed. (OID)

13765

DISULFIDE INTERCHANGE BY IONIZING RADIATION. D. Cavallini, B. Mondovi, B. Giovanella, and C. De Marco (Università, Modena, Italy; Università, Rome; and Regina Elena Inst. for Cancer Research, Rome). Science 131, 1441-2(1960).

The irradiation of a solution of two symmetric disulfides produces detectable amounts of the nonsymmetric mixed disulfide. The effect is abolished by the addition of ethylmaleimide. The finding indicates that radiation causes a disulfide opening and recombining process which may be of radiobiological interest. (auth)

13766

THE CHEMICAL EFFECTS OF RADIATIVE THERMAL NEUTRON CAPTURE. PART 6. POTASSIUM CHLORORHENITE, ISOTOPE EFFECTS AND THE ANNEALING PROCESS. D. J. Apers and A. G. Maddock. Trans. Faraday Soc. 56, 498-508(1960) Apr.

The thermal annealing of the recoil damage, following neutron capture in potassium chlororhenite, was investigated for both the Re^{186} and Re^{188} isotopes. Although the initial retentions are different the two isotopic fragments seem to recombine at the same speed. The slow annealing process is shown to be zero order with a very small energy of activation. The radiation annealing and a combination radiation and thermal annealing were also examined. (auth)

13767

THE CHEMICAL EFFECTS OF RADIATIVE THERMAL NEUTRON CAPTURE. PART 7. CALCIUM BROMATE. A. G. Maddock and H. Müller (Univ. Chemical Lab., Cambridge, Eng.). Trans. Faraday Soc. 56, 509-18(1960) Apr.

The initial retention of calcium bromate of 18% is increased by thermal and radiation annealing, but drops on pre-irradiation with ionizing radiation. A combination of these annealing methods has been investigated. The data indicate that electronic processes contribute to the change of retention. (auth)

13768

RADIOPHYSIKALISCHES UND RADIOCHEMISCHES GRUNDPRAKTIKUM. (Basic Radiophysical and Radiochemical Practices). Lieselott Herforth and Hartwig Koch. Hochschulbücher für Physik. Band 31. Franz X. Eder and Robert Rompe, eds. Berlin, Deutscher Verlag der Wissenschaften, 1959. 480p.

A textbook is presented covering radiochemical procedures except for the electronics of some of the equipment involved. Several chapters are devoted to radiation measurement and monitoring. Separation procedures and tracer techniques are discussed in the other chapters. (T.R.H.)

13769

IMPROVEMENTS IN OR RELATING TO THE POLYMERIZATION OF OLEFINES. (to Simon Lyon Ruskin). British Patent 832,483. Apr. 13, 1960.

Radiation polymerization of olefins with irradiated catalyst is described. In an example, 20 g at TiO_2 are irradiated to 10^8 r and suspended in 200 cc of heptane. Ethylene is bubbled through and further irradiation causes polyethylene to precipitate. (T.R.H.)

13770

PROCESS FOR CARRYING OUT OXIDATION-REDUCTION REACTIONS. (to Union Carbide Corp.). British Patent 832,747. Apr. 13, 1960.

An irradiation process for controlling certain oxidation-reduction reactions is given. In one example TiO_2 and glycerol are mixed in equal parts and irradiated to 10^8 r/g. The resulting products are Ti metal and a mixture mostly glyceric acid. In another example 3 parts acetic acid are mixed with 2 of TiO_2 and irradiated to 10^8 r/g. Ti metal, citric acid, and water are produced. (T.R.H.)

Raw Materials and Feed Materials

13771 BM-RI-5599

Bureau of Mines.

TECHNOLOGY OF BASTNASITE. J. S. Berber, V. E. Shaw, A. C. Rice, R. E. Lindstrom, and D. J. Bauer. Nov. 1958. 23p.

Bastnasite is a natural fluocarbonate of the cerium group and affords an abundant and high-grade source of the lighter rare-earth elements. By the use of a combination of techniques the processing of a bastnasite concentrate to obtain the individual rare-earth elements, or groups of elements, was accomplished. (W.L.H.)

13772 CCCO-834

Catalytic Construction Co., Philadelphia.

OPERATING MANUAL FOR SUPERVISORY PERSONNEL. NEW MATERIALS FEED PREPARATION PLANT PROCESS AND OPERATING EQUIPMENT. IX. SECTION 37-3. Process Engineering Report. Job No. 3542. R. P. Lukens, S. H. Abrams, H. R. Carr, P. S. Lindsey, T. E. Grimac, F. J. Knoll, and H. H. Bulkowski. Dec. 9, 1952. Decl. Mar. 15, 1960. 182p. Contract AT(30-1)-1060. OTS.

The function of the feed materials plant is to prepare Th ingots starting with $Th(NO_3)_4$. The information required for operation of the plant is given along with general data concerning the process. (T.R.H.)

13773 NP-8599

Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.

MONTHLY REPORT [OF] DEVELOPMENT, MARCH 1960. 13p. (D-60-2).

The use of porous stainless steel diffusers in carbonate leaching improved the uranium extraction but decreased the air rate to 0.273 scfm per sq ft pulp area. Tests on pilot plant and plant barrens indicated a final carbonate barren of 0.003 g/l U_3O_8 and a sodium amalgam usage of <1 g Na/g U_3O_8. Preliminary results show retention time to be less than 30 minutes. A flowsheet is presented for a continuous amalgam reduction circuit consisting of a sodium amalgam cell and continuous solution-amalgam contactor. Attempts to reduce the nitric acid consumption of the sodium chlorate ferric ion slag treatment and thereby raise the pH to above 3.9 resulted in a sharp reduction in uranium recovery. No corrosion of electrodes due to shielding failures was observed in five months of operation, indicating that Fiberglas resin is resistant to 30% nitric acid containing 1000 ppm chloride at below 18°C. It was established that ammonium diuranate (ADU) pellets do not form on first drying of the ADU precipitate. Best results relative to hardness and uniformity of size pellets were obtained when water was evaporated very fast. The green and sintered densities obtained at 20,000 psi were 4.50 and 10.13 g/cc, respectively, and at 30,000 psi, they were 4.76 and 10.24 g/cc, respectively. Pretreatment produced no effect on the sintered density of ADU at reduction temperatures above 600°C in the vertical plate reactor. Sintered densities greater than 10.40 g/cc were obtained in the tube furnace at 400 to 550°C. Sintered densities greater than 10.5 g/cc were obtained from spray-dried ADU reduced in the tube furnace at 500 to 550°C. By increasing the temperature in the range 1300 to 1700°C, UO_2 sintered density increased. (For previous period see NP-8510.) (C.J.G.)

13774 NP-8675

Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.

RESEARCH AND DEVELOPMENT QUARTERLY REPORT [FOR] JANUARY TO MARCH 1960. 24p. (R60-1).

In the solvent-in-pulp program, a series of batch counter-current extraction showed a free acid level of 10 g/l to result in minimum solvent loss in solids at all agitation speeds tested. Amine concentration in the solids ranged from 0.001 to 0.006%. Operating conditions and flowsheet for a small-scale pilot plant run are included. The state of oxidation of the dissolved iron showed no apparent effect on amine extraction tests on acid leach solution at redox levels of 380 and 590 mv. Ammonium chloride stripping appears most effective, of the systems studied thus far, in producing a nuclear grade product by solvent extraction. Work is in progress to obtain sufficient product for neutron absorption tests. Tests have been renewed on sulfuric acid stripping with the object of producing solutions suitable for electrolytic reduction. Tests on solvent extraction from carbonate solution with Aliquat 336 were unsuccessful and have been discontinued. Several methods were investigated for decreasing vanadium contamination in uranium dioxide produced from Beaverlodge solution by amalgam reduction. Data are presented from sintering tests on amalgam reduction products. Sintering tests were run on uranium dioxide samples obtained from electrolytically-prepared uranous sulfate by decomposition under hydrogen at 550°C. Maximum sintered density was 10.09 g/cc. Solubility data were obtained for the system uranous sulfate-ammonium sulfate. These solubility data may be useful in developing a method of preparing uranium dioxide from uranous sulfate by wet-way hydrolysis rather than by thermal decomposition. (auth)

13775

THE ECONOMY OF URANIUM MINERALS AND THEIR CONCENTRATES. D. Francisco Pascual Martinez (Junta de Energia Nuclear, Madrid). *Energia nuclear (Madrid) 4*, No. 13, 19-34(1960) Jan.-Mar. (In Spanish)

The discovery of uranium fission and its peaceful applications has led to the growing economic importance of uranium concentrates so that at present the value of the uranium concentrate produced in the free world is exceeded by only five minerals. The uranium reserves and the production of uranium concentrates are summarized. The use of uranium concentrates for military purposes, for the production of electrical energy, and other applications is reviewed. The cost of the production of uranium concentrates in various countries is discussed and the purchase price of minerals and concentrates is considered. (J.S.R.)

13776

FLUIDIZATION IN NUCLEAR TECHNOLOGY. A. Rodrigo Otero and R. Rodríguez-Solano (Junta de Energia Nuclear, Madrid). *Energia nuclear (Madrid) 4*, No. 13, 44-64(1960) Jan.-Mar. (In Spanish)

The use of fluidization techniques in the production of specific uranium compounds is discussed. The factors affecting processes in fluidized beds are first considered. Then the procedures used for the production of uranium trioxide, uranium dioxide, uranium tetrafluoride, and uranium hexafluoride are described. Typical reactors and yields are discussed. Application of fluidized bed techniques to the processing of irradiated fuel elements is described. (J.S.R.)

Separation Processes

13777 CF-59-11-132

Oak Ridge National Lab., Tenn.

CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION C MONTHLY PROGRESS REPORT [FOR] NOVEMBER 1959. K. B. Brown, K. A. Allen, C. A. Blake, C. F. Coleman, D. J. Crouse, and A. T. Gresky. Jan. 12, 1960. 52p. Contract [W-7405-eng-26]. OTS.

Bench-scale equipment and process for continuous stripping of uranium from di(2-ethylhexyl)phosphoric acid in kerosene with ammonium carbonate solution were demonstrated. Studies of corrosion and fission-product metal extraction from nitrate solutions with trilaurylamine are being conducted. Data on extraction of Mo, Zr, Sm, and Ru are discussed. Scouting experiments involving the use of di-*sec*-butyl phenylphosphonate and di(2-ethylhexyl)phosphoric acid for separation of contaminating thorium from Thorex U^{233} are also examined. Reagent cleanup procedures were applied to severely degraded TBP—Amsco systems, and it is noted that scrubbing the nitrated diluent with alumina appears to be the best method of removing hydrolysis products. Irradiation of organic process solvents such as tributylphosphate, di-*n*-butyl-phenylphosphonate, and di-*sec*-butyl phenylphosphonate is reported, and data on radiolytic production of organic acid are tabulated. Highly irradiated solvents could be cleaned up with Na_2CO_3—Al_2O_3 solutions. Data on the formation constants for thorium sulfate complexes are also discussed. (J.R.D.)

13778 DP-444

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

IMPROVED METHOD FOR PRECIPITATING MANGANESE DIOXIDE. Harold J. Clark, Jr. Feb. 1960. 12p. Contract AT(07-2)-1. OTS.

An improved method for precipitating manganese dioxide was demonstrated that significantly increases the allowable feed rate of the Purex head-end centrifuge. The effects of several process variables are discussed. (auth)

13779 HW-60597

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE ZIRFLEX PROCESS; INTERIM DEVELOPMENT SUMMARY. A. M. Platt and C. R. Cooley. June 24, 1959. 31p. Contract AT(45-1)-1350. OTS.

The Zircaloy-clad fuels and the application of the Zirflex Process for dissolution are discussed. Zirflex chemical flowsheets are presented as developed by pilot plant operations. The Zirflex Process is applicable to the reprocessing of fuels from the Dresden Reactor and the PWR Reactor. Other applications of the process are the Plutonium Recycle Test Reactor fuels and the New Production Reactor fuels; possible fuels from the Experimental Breeder Reactor; NPD-2 fuels; and fuels from Carolina-Virginia Nuclear Power Associates Reactor. (W.L.H.)

13780 HW-61609

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ANALYSIS OF A NUCLEAR INCIDENT IN A REDOX DISSOLVER. V. I. Neeley. Aug. 24, 1959. 17p. Contract AT(45-1)-1350. OTS.

Three types of nuclear incidents which may occur in dissolvers are considered. In one case a prompt critical burst in an abnormal concentration of uranium solution in a localized region of the dissolver is discussed, in a second case a slightly supercritical uranium metal system is examined, and in the third case a uranium metal system is considered which is supercritical or prompt critical such that the *e* folding time for power increase is much less than the *e* folding time for heat transfer from the metal to the moderator. The severity of each type of incident is assessed. (J.R.D.)

13781 HW-62840

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NON-PRODUCTION FUELS REPROCESSING, CENTRIFUGATION STUDIES ON VARIOUS DISSOLVER EFFLUENT SOLUTIONS. L. C. Amos. Dec. 3, 1959. Appendix A: NPF CLARIFICATION STUDIES. M. K. Harmon. July 17, 1959. Appendix B: NON-PRODUCTION FUEL CLARIFICATION STUDIES. R. E. Burns. Sept. 24, 1959. 10p. Contract AT(45-1)-1350. OTS.

The proposed flowsheets for reprocessing of non-production fuels include centrifugal separation of particulate matter from various dissolver effluent solutions. The settling characteristics of process solids were determined in water and in cold process solutions. Uranium dioxide particles will be recovered from Zirflex and Sulfex cladding waste solutions, and core-dissolver solutions will be centrifuged for removal of ZrO_2, metallic slimes, siliceous matter, and uranium-bearing solids. (W.L.H.)

13782 HW-63043

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ZIRFLEX DISSOLUTION OF THE ANNULAR CLADDING OF SIMULATED POWER FUEL ELEMENTS. P. W. Smith. Dec. 9, 1959. 5p. Contract AT(45-1)-1350. OTS.

A study was conducted to compare the estimated dissolution rate of Zircaloy-2 clad annular fuel elements on the fully exposed metal with that in the annuli. Results indicate that decladding of these elements should proceed uniformly on all surfaces. Heat balance data from the study are also reported. (J.R.D.)

13783 IDO-14459

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NEPTUNIUM SEPARATION FROM URANIUM, PLUTONIUM, AND FISSION PRODUCTS: AN ANNOTATED BIBLIOGRAPHY. B. J. Newby. Dec. 29, 1958. Decl. June 9, 1959. 29p. Contract AT(10-1)-205. OTS.

An annotated bibliography on Np chemistry is presented. Factors involved in separation and isolation of Np from U, Pu, and fission products are stressed. (auth)

13784 IDO-14497

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

DISSOLUTION OF ZIRCONIUM AND ZIRCALOY-2 IN NITRIC-HYDROFLUORIC ACID MIXTURES AT REFLUX TEMPERATURES. E. M. Vander Wall, E. M. Whitener, and D. L. Bauer. Sept. 1959. 29p. Contract AT(10-1)-205. OTS.

The initial rate constants were obtained for zirconium and Zircaloy-2 dissolution at reflux temperatures in nitric—hydrofluoric acid mixtures. Variation of the nitric acid concentration in these solutions had very little effect on the initial dissolution rate, except for the change in the reflux temperature. The nitric acid concentration exhibited an appreciable effect on the average dissolution rate over longer periods of time. An empirical treatment of the rates over extended periods is presented. The maximum attainable rates for zirconium dissolution, adjusted to an initial 1*M* hydrofluoric acid concentration, were determined at lower temperatures. Stability of resultant Zircaloy-2 dissolver solutions is reported for both nitric—hydrofluoric acid mixtures and nitric—oxalic—hydrofluoric acid mixtures. Possible reactions and some analyses of off-gases from these dissolutions are given. (auth)

13785 NP-8629

Israel. Atomic Energy Commission, Tel Aviv.

ON THE CO-PRECIPITATION OF CALCIUM WITH STRONTIUM NITRATE FROM CONCENTRATED NITRIC ACID SOLUTIONS. Joel Gat, Eliezer Rappaport, and Ilan Teucher. 1960. 12p. (IA-516).

The results of co-precipitation of Ca with $Sr(NO_3)_2$ from HNO_3 solutions of 60, 63, 65, 68, 70, 72, and 75% HNO_3 are reported. The effect of acid concentration on the co-precipitation phenomena is discussed. (C.J.G.)

13786 NP-8662

France. Commissariat à l'Énergie Atomique, Paris *and* Polish Academy of Sciences. Inst. of Nuclear Research. Warsaw.

THE INFLUENCE OF DILUENT POLARITY ON THE EXTRACTION OF NEPTUNIUM AND URANIUM COMPOUNDS TO ORGANIC MEDIA. Report No. 127/V. M. Taube. Dec. 1959. 14p.

The influence of polarity in chloroform, benzene, and carbon tetrachloride two-component diluent mixtures on the extraction of uranium(VI) and neptunium(IV) and (VI) complexes (tributyl-*n*-phosphate, tetrabutyl-ammonium nitrate, and trilaurilamine) was studied. The results are interpreted in terms of size of complex, diluent structure, and of hole formation in organic phase and the dipole interaction between complex and diluent. (auth)

13787 ORNL-2918

Oak Ridge National Lab., Tenn.

FUSED SALT FUEL PROCESSING IN THE ORNL VOLATILITY PILOT PLANT. C. L. Whitmarsh and W. H. Carr. May 20, 1960. 42p. Contract W-7405-eng-26. OTS.

A pilot plant development program was carried out for the Fluoride Volatility process, in which UF_4 contained in a mixture of molten fluorides is fluorinated to the volatile UF_6, which is further decontaminated by sorption-desorption in fixed NaF beds. The recovery, as UF_6, of ~134 kg of fully enriched uranium represented 97.93% of that in the feed, with an additional 1.76% being reclaimed from the NaF and in equipment cleanout; measured losses were 0.03%. The 0.28% unaccounted for is attributed to an observed, but unmeasured, leak. The UF_6 product analyzed >99.5% of theoretical uranium concentration and contained about 500 ppm of total cation impurities. Since no fission product activity was detected in the product, plant-scale decontamination factors were not determinable. The activity of the material processed was only 10^5 gross gamma counts/min/mg U. The chief difficulties were plugging of molten salt lines, the maintaining of a gastight system, and plugging of the NaF beds. Corrosion, though greater than normal in chemical processing plants, did not limit operation. (auth)

13788 TID-5799
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DISTILLATIONAL PURIFICATION OF IRRADIATED TRIBUTYL PHOSPHATE IN KEROSENE IN KEROSENE-TYPE DILUENT. Final Report [for] December 1, 1958 to November 1, 1959. Fred Sicilio, T. H. Goodgame, and Bert Wilkins, Jr. Jan. 31, 1960. 54p. Project No. A-428. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1374. OTS.

A study to determine the feasibility of fractionation or a combination of fractionation and washing as a means of purifying radiation-damaged Purex Process solvent was conducted. It was found that flash distillation of the Purex TBP—Amsco mixture into the two components followed by distillation of each component may be performed in a trouble-free manner. Contact studies made with U^{233} and Ru^{106} show that the extraction scrubbing and stripping characteristics of the distilled irradiated fractions are comparable to the distilled unirradiated fractions. (J.R.D.)

13789
QUANTITATIVE ANALYSIS OF RADIONUCLIDES IN PROCESS AND ENVIRONMENTAL SAMPLES. A. L. Boni (E. I. du Pont de Nemours & Co., Aiken, S. C.). Anal. Chem. 32, 599-604(1960) May.

An analytical method is developed for the radiochemical separation and quantitative recovery of ruthenium, zirconium, niobium, neptunium, cobalt, iron, zinc, strontium, rare earths, chromium, and cesium from a wide variety of natural materials. The method is based on the anion exchange properties of the various radionuclides, although both ion exchange and precipitation techniques are incorporated. Volatilization is used to eliminate iodine. The recovery of the individual isotopes is greater than 95% with a standard deviation of ±4%. The decontamination factors for the individual radionuclides are greater than 10^4 for all ion exchange separations and greater than 10^3 for gravimetric separations. (auth)

13790
SEPARATION OF THE ALKALI METAL CATIONS BY ELECTROCHROMATOGRAPHY IN PAPER. Murray M. Tuckerman and Harold H. Strain (Argonne National Lab., Lemont, Ill.). Anal. Chem. 32, 695-8(1960) May.

The mobilities of sodium, potassium, rubidium, and cesium cations were measured in various organic solvents with paper as the stabilizing medium. A useful separation of these alkali metal ions was obtained in nitromethane, 0.2M in ammonium formate and 0.4M in trichloroacetic acid, in 3 hours with a potential gradient of 15.0 volts per cm. (auth)

13791
CONCEPTUAL DESIGN OF PYROMETALLURGICAL REPROCESSING PLANT. Louis Basel (Atomic Power Development Associates, Inc., Detroit) and Joseph Koslov (Vitro Corp. of America, New York). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 97-106(1959).

A pyrometallurgical reprocessing plant for handling fuel from a 500-Mw fast-breeder reactor is described. Also included are capital and operating costs and a discussion of problems requiring further investigation. (auth)

13792
THE NITROPHOS EXTRACTION PROCESS FOR THE SEPARATION OF ZIRCONIUM AND HAFNIUM. Wayne H. Keller (National Research Corp., Pensacola, Fla.) and Irwin S. Zonis (Dixon Chemical and Research Corp., Bloomfield, N. J.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 107-12(1959).

The several possible processes for separating zirconium and hafnium are reviewed briefly and the reasons for selecting the Nitrophos liquid-liquid extraction process, by means of a nitric acid-tributyl phosphate system, are given. The laboratory and pilot plant experiments are described and the data presented. Under the conditions studied, reactor-grade zirconium can be prepared in a column with less than ten theoretical stages. The commercial plant design is described and preliminary operating results are given. Purified zirconium containing less than 50 ppm hafnium has been produced in large-scale operations. (auth)

13793
A TECHNICAL AND ECONOMIC ANALYSIS OF THE SEPARATION OF PLUTONIUM AND FISSION PRODUCTS FROM IRRADIATED NUCLEAR REACTOR FUELS. H. A. Ohlgren and J. G. Lewis (American Metal Products, Detroit); M. E. Weech (Phillips Petroleum Co., Idaho Falls, Idaho); and G. M. Wensch (U. S. Atomic Energy Commission, Washington, D. C.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 125-41(1959).

The technical background for the chemical processing of irradiated nuclear reactor fuels is discussed, and aqueous solvent extraction methods for the separation of uranium from plutonium and fission products are briefly described. An example is presented of the application of aqueous solvent extraction methods to the processing of the fuel and blanket elements of a fast-breeder power reactor operating on uranium and plutonium. Estimated capital and operating costs are presented for an aqueous separation of plutonium and fission products from irradiated fuel elements. A possible plant for the chemical processing of the irradiated reactor elements, integrated in location and function with the remaining parts of a nuclear reactor system, is also described. (auth)

13794
THE SEPARATION OF URANIUM AND THORIUM BY MEANS OF ION EXCHANGE RESINS SPECIFIC FOR THE THORIUM ION. Jean Petit and Roger Lumbroso. Compt. rend. 250, 2568-9(1960) Apr. 4. (In French)

The separation of uranium and thorium is made quantitatively by means of a resin of the formophenolic type containing in its tridimensional lattice the salicylic acid group. It is made in a simple manner from a resin of the same type containing the sulfosalicylic acid group. One resin of the formophenolic type containing only sulfonic groups was studied for comparison. (tr-auth)

13795
SOME BENTONITE CLAYS FOR DECONTAMINATING WATER CONTAINING RADIOACTIVE CESIUM AND STRONTIUM. E. Cerrai, A. Scaroni, and C. Triulzi (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 253-9(1960) Apr. (In English)

The behavior of some types of Italian clay was investigated in the decontamination of water containing strontium alone or cesium-strontium mixtures. The operating conditions were studied concerning the effect of solution pH, the required amount of adsorbent material, its composition, and the influence of natural salts contained in tap water. Two kinds of materials were considered: one consisting of ordinary bentonite (sodium bentonite and calcium bentonite) and the other of special activated products (Morillo sigma L and Morillo sigma Q). The activated types proved more efficient as decontaminants and made the sludge filtration easier. With the aim of obtaining a good decontamination together with a high filtration speed, some mixtures of an ordinary bentonite (calcium bentonite) with an activated product (Morillo sigma L) were investigated. (auth)

13796

SCAVENGING RADIONUCLIDES IN SUBSTITUTE OCEAN WATER. John Rosinski and C. T. Nagamoto (Illinois Inst. of Tech., Chicago). Ind. Eng. Chem. 52, 429-32(1960) May.

Alum, aluminum sec-butoxide, ferric ethoxide, and a ferrous salt-permanganate system were investigated for their ability to scavenge radionuclides from substitute ocean water. These radionuclides were in the form of mixed fission products in I^{131} dissolver solution; specific radionuclides were also investigated. The ferrous salt-permanganate system, which produced a precipitate of ferric hydroxide and manganese dioxide hydrate, was found to be the best scavenger; the concentrations studied were 10 to 50 ppm of $KMnO_4$ (or $Ca(MnO_4)_2$) and 29 to 164 ppm of $FeSO_4$. For 25 or 50 ppm of $KMnO_4$, approximately 95% of the gamma activity was removed. Only Cs and Sr were not removed; however, Sr was scavenged up to 20%. Neither ferric hydroxide nor manganese dioxide proved a good scavenger by itself and were much slower in settling. The effect of aging the mixed hydroxide precipitate on scavenging efficiency was also studied. Addition of Flocs 111, a flocculant, was found to improve settling and hence scavenging. (D.L.C.)

13797

STUDY ON THE EXTRACTION OF URANIUM BY TETRAPHENYLPHOSPHONIUM CHLORIDE (TPPC). M. Shinagawa and K. Katsura (Hiroshima Univ.). J. Atomic Energy Soc. Japan 2, 147-52(1960) Mar. (In Japanese)

For the purpose of using TPPC (Tetraphenylphosphonium chloride) as an extraction reagent, uranyl ion was changed to the complex anion with benzoic acid. Tetraphenylphosphonium uranyl tribenzoate is extracted into chloroform layer from the buffer solution containing benzoic acid and sodium benzoate. The following subjects are treated: proportionality between polarographic diffusion current and uranium concentration, interference of several ions with the extraction of uranium, effects of TPPC concentration on the percentage extraction of uranium and the ratio of uranium to TPPC, optimum pH, effects of the concentration of the complexing agent on the percentage extraction of uranium, and percentage extraction of fission products and the other radioactive elements. A method is given for the separation of uranium with TPPC. (auth)

13798

SEPARATION OF CESIUM FROM FISSION PRODUCT WASTE SOLUTIONS. P. R. Gray (Dow Chemical Co., Midland, Mich.). J. Inorg. & Nuclear Chem. 12, 304-14 (1960) Feb.

A method is presented for separating cesium from a synthetic fission product solution. The fission products are converted to bromides with hydrobromic acid and concentrated by evaporation. Impure crystals of cesium molybdenyl pentabromide separate upon cooling. The final cesium bromide product (>99% CsBr, <1% RbBr) is obtained radiochemically pure in >95% yield. (auth)

13799

THE EXTRACTION OF NITRIC ACID AND THORIUM NITRATE BY TRI-n-OCTYLPHOSPHINE OXIDE IN CYCLOHEXANE. R. A. Zingaro and J. C. White (Oak Ridge National Lab., Tenn.). J. Inorg. & Nuclear Chem. 12, 315-26(1960) Feb.

The distribution of nitric acid and thorium(IV) nitrate between aqueous solutions and solutions of tri-n-octylphosphine oxide in cyclohexane was examined as a function of temperature and various extraction variables at constant aqueous ionic strength. Up to a maximum concentration of 0.4 M, the distribution behavior of nitric acid was found to be consistent with first power dependency on the organic reagent concentration. In the case of acidic thorium nitrate solutions, provided the concentration of both thorium(IV) and hydrogen ion are maintained below 0.01 M, the extraction of the metal as $Th(NO_3)_4 \cdot 3TOPO$ is indicated. At higher concentrations the formation of organic adducts containing both the metal nitrate and nitric acid takes place. The temperature dependency of the extraction is very small or negligible in both cases. Solubility and density of saturated tri-n-octylphosphine oxide solutions in cyclohexane in the temperature range of 6.5 to 35°C was also measured. (auth)

13800

THE EXTRACTION OF ACTINIDE ELEMENTS FROM NITRIC ACID SOLUTIONS BY TRI-n-OCTYLAMINE. W. E. Keder, J. C. Sheppard, and A. S. Wilson (General Electric Co., Richland, Wash.). J. Inorg. & Nuclear Chem. 12, 327-35(1960) Feb.

The extraction of Th, Pa, U, Np, Pu, and Am from nitric acid solutions by tri-n-octylamine in xylene was investigated and the effects of acid and amine concentrations were measured. The extraction of Np(IV) and Pu(IV) was found to be much greater than any of the other oxidation states studied. The nitrate complex species predominating in the amine phase is postulated in the case of the tetravalent ions. (auth)

13801

SOLVENT EXTRACTION OF SCANDIUM, YTTRIUM AND LANTHANUM BY THE MONOALKYL ORTHOPHOSPHORIC ACIDS. C. G. Warren and J. F. Suttle (Univ. of Mexico, Albuquerque). J. Inorg. & Nuclear Chem. 12, 335-42(1960) Feb.

The extraction of scandium(III), yttrium(III), and lanthanum(III) into an amyl alcohol solution containing the mono(n-alkyl) orthophosphoric acid, H_2RPO_4, from an aqueous HNO_3 solution was investigated. The variation of the distribution of these elements with the concentration of both HNO_3 and H_2RPO_4 indicated that the complexes, tentatively identified as $Sc(HRPO_4)_3$, $HYb(HRPO_4)_4$, and $HLa(HRPO_4)_4$, were extracted. The mono(n-alkyl) orthophosphoric acids were synthesized by first preparing the alkyl dichloro phosphate from the normal alcohol and phosphorus (V) oxychloride. This was hydrolyzed to the corresponding H_2RPO_4. (auth)

13802

THE SEPARATION AND ESTIMATION OF NITRO AND NON-NITRO (NITRATO) COMPLEXES OF NITROSYLRUTHENIUM IN NITRIC ACID SOLUTION BY PAPER CHROMATOGRAPHY. A. G. Wain, P. G. M. Brown, and J. M. Fletcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 12, 346-9(1960) Feb.

Ascending paper chromatography procedures are described for the separation of nitro and nitrato complexes of nitrosylruthenium in nitric acid solution. The elutants are methyl isopropyl ketone and dibutyl cellosolve. Tables of R_F for these elutants and each complex are given. (D.L.C.)

13803

CONFERENCE ON DIRECT CONVERSION OF NUCLEAR ENERGY, AMERICAN NUCLEAR SOCIETY. Nuclear Eng. 5, 216(1960) May.

I^{135} removal from reactors is important because it is a health hazard and a precursor of Xe^{135}. Since iodine is a readily condensable vapor, its removal presents problems, e.g., aerosol or dust particles in air will absorb iodine vapor. Therefore, the choice of a suitable iodine treatment system must be made bearing in mind the possible physical forms in which iodine may be present. Liquid and solid absorbers for the removal of iodine from gas streams and their limitations are discussed; water, caustic soda solution, metals, silver compounds, activated carbon, graphite, and molecular sieves are included, with emphasis on activated carbon. The factors involved in the choice of an iodine removal system are illustrated in the problem of an in-pile testing rig under various fault conditions, e.g., coolant and fuel element failure. The system finally chosen is one with an activated carbon bed, but it is emphasized that no one iodine removal system can be used for all problems. (D.L.C.)

13804

IMPROVEMENTS IN OR RELATING TO A PROCESS FOR THE TREATMENT OF AN AQUEOUS HOMOGENEOUS NUCLEAR REACTOR FUEL. Eugen Glueckauf (to United Kingdom Atomic Energy Authority). British Patent 832,506. Apr. 13, 1960.

A process is given for treatment of aqueous homogeneous reactor fuel. In an example, cerium sulfate is added to the UO_2SO_4 fuel solution at a rate faster than rare-earth fission product formation. These fission products coprecipitate with $Ce_2(SO_4)_3$. In another example silver sulfate is used to precipitate halogens. (T.R.H.)

13805

IMPROVEMENTS IN OR RELATING TO THE SEPARATION OF ZIRCONIUM AND HAFNIUM COMPOUNDS. (to E. I. du Pont de Nemours & Co.). British Patent 833,103. Apr. 21, 1960.

A fractional distillation method is given for separating Zr from Hf and purifying Zr. In an example a column of stainless steel coils or ceramic saddles is used, and a protective Ar atmosphere fills the apparatus and produces a pressure of 19,400 mm Hg. The temperature is carefully controlled at certain points in the apparatus. A performance of 30 theoretical plates is needed for pure $ZrCl_4$ separation. Using a longer column and a higher reflux ratio will allow separation of pure $HfCl_4$. A stainless steel column design for the process is described. (T.R.H.)

13806

PROCESSES OF RECLAIMING URANIUM FROM SOLUTIONS. (to United Kingdom Atomic Energy Authority). British Patent 833,622. Apr. 27, 1960.

A process for recovering U from calutrons is described. The UCl_4 is washed out with water and the U reduced by scrap iron. The pH is raised to 4.4 and ammonia added to precipitate $U(OH)_4$. The precipitate is slurried in water and froth-flotation treated with eucalyptus oil; then the $U(OH)_4$ is filtered out and calcined to UO_2. The UO_2 is converted to UCl_4 by CCl_4 at 450°C, and the UCl_4 purified by molecular distillation. (T.R.H.)

13807

SELECTIVE PRECIPITATION OF URANIUM PHOSPHATE. (to United Kingdom Atomic Energy Authority). British Patent 833,624. Apr. 27, 1960.

A process is given for recovering U from acid leach liquors by selective precipitation as phosphate. In an example, wet ore residue from which precious metals have been extracted by cyanide leaching was treated with H_2SO_4 and MnO_2 to leach the U out and oxidize Fe to Fe^{3+} A limestone slurry was added to precipitate Fe, after which the pregnant liquor was filtered off. The solution was reduced by Fe powder and H_2SO_4 and tetrasodiumpyrophosphate added to precipitate U. The precipitate was washed with water and the wash recycled. Another example is given to describe the process as carried out on a plant scale. (T.R.H.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

13808 58-GL-146

General Electric Co. General Engineering Lab., Schenectady, N. Y.

VACUUM PROCESS EVALUATION. D. J. Santeler. May 12, 1958. 44p.

A technique to determine the outgassing occurring within a vacuum system as a continuous function of time and to analyze the resulting curve for information on the source and nature of the outgassing is described. Applications in determining the optimum combination of such parameters as temperature, time, materials, restrictions, and pumps on hermetic volume exhaust and cellulose dehydration are discussed. This technique was also used to study such phenomena as the outgassing characteristics of insulating materials and vacuum gages, the flow of gasses through orifices and short tubes, and the gettering action of various materials. A digital computer and data reduction facilities were incorporated to eliminate the detailed hand calculations and plotting. This has resulted in a rapid and inexpensive method for the study of vacuum engineering problems. (auth)

13809 CF-58-11-57

Oak Ridge National Lab., Tenn.

REMOTE SHEARING. A. A. Abbatiello. Nov. 14, 1958. 14p. OTS.

A hydraulic shearing tool was developed for application to remote severing of pipes or structural members. The tool is positioned or rotated about its axis by hydraulic operators utilizing the shear hydraulic power unit. It was designed for a C-type suspension from a building crane to provide an offset for operation through an opening in the ceiling of a shielded cell. The shear has been proven for cutting metal sections up to 4 inch, schedule 40 stainless steel pipe. (auth)

13810 NAA-SR-4947

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THERMAL CYCLING AND LEAKAGE TESTS OF 12-INCH VALVES FOR SODIUM SERVICE. C. J. Baroczy. May 1, 1960. 38p. Contract AT-11-1-GEN-8. OTS.

Tests were performed to determine the effect of thermal cycling on the across-the-seat leakage characteristics of valves for use in the sodium coolant system of the Hallam Nuclear Power Facility. Four 12-in. valves were cycled between 680 and 1100°F in a sodium loop and periodically tested for across-the-seat sodium leakage. The valves tested were two throttling (ball) valves and two blocking (gate) valves. The first-ball valve had a consistent leakage pattern which was primarily a function of valve temperature, but also varied with pressure differential and number of thermal cycles. The second ball valve showed high initial leakage rates which became excessive after some sodium circulation. Using data obtained with the first-ball valve, a general equation for the rate of leakage across the valve seat was obtained for this type and size of ball-valve as a function of temperature, pressure differential, and number of thermal cycles. No sodium leakage was exhibited by either gate valve throughout the test. None of the valves exhibited any leakage through the freeze-seal along the stem. (auth)

13811 ORNL-2841
Oak Ridge National Lab., Tenn.
DESIGN, DEVELOPMENT, AND OPERATION OF METAL-DIAPHRAGM REACTOR-SERVICE PUMPS. E. C. Hise. May 10, 1960. 65p. Contract W-7405-eng-26. OTS.

The design, development, and operation of metal-diaphragm service pumps for aqueous homogeneous reactors are discussed. It is shown that with proper design and materials selection, the diaphragm heads and check valves can operate continuously for about two years. (C.J.G.)

13812 ORNL-2923
Oak Ridge National Lab., Tenn.
DEVELOPMENT OF AN ELECTROLYTIC CELL FOR REMOVAL OF NICKEL FROM HRT FUEL SOLUTIONS. E. L. Youngblood. May 19, 1960. 21p. Contract W-7405-eng-26. OTS.

An HRT prototype electrolytic cell with a mercury cathode and a platinum anode was tested for the separation of nickel and manganese from a simulated HRT fuel solution. Approximately 90% nickel removal and 80% manganese removal was accomplished in 290 amp-hr per liter. The manganese separation required replacement of the liquid mercury cathode after one half of the nickel was removed. In the course of this electrolysis, essentially all of the copper was removed and 60% of the uranium was reduced to the four valence state. The radiation stability of the insulators and corrosion of the cell are analyzed. (auth)

13813 TID-4100(1st Rev., Suppl. 7)
Technical Information Service Extension, AEC
SUPPLEMENTAL INSERT SHEETS FOR ENGINEERING MATERIALS LIST. Richard E. C. Duthie, ed. Mar. 1960. 47p. TISE.

Descriptions of engineering materials including computers, critical assemblies, engineering and hot laboratory equipment, instruments, metallurgical equipment, reactors, radiation sources, and shielded containers are presented. (J.R.D.)

13814
LABORATORY FACILITIES FOR NUCLEAR ENGINEERING EDUCATION AT MIT. T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 91-5(1959).

The curriculum and laboratory facilities for graduate study in nuclear engineering at Massachusetts Institute of Technology are described. Among the items discussed is the 1-Mw heavy-water-cooled and -moderated research reactor which will be used in investigations of neutron therapy for cancer. (D.L.C.)

13815
ON THE DRAG OF A SPHERICAL SATELLITE MOVING IN A PARTIALLY IONIZED ATMOSPHERE. H. H. C. Chang and M. C. Smith (Hughes Aircraft Co., Culver City, Calif.). J. Brit. Interplanet. Soc. 17, 199-205(1960) Jan.-Feb.

The drag on a spherical Earth satellite due to neutral and charged particles is discussed. The temperatures of the electrons and positive ions are assumed to be approximately equal and for most satellites it follows that the satellite sweeps out ions and neutral particles only along its direction of motion but is bombarded from all directions by electrons. An important parameter which determines the drag of charged particles is the charge (or the potential) of the satellite. This charge is determined for two different cases by the boundary condition that at equilibrium the total current to the satellite is zero. Competitive processes which would charge the satellite oppositely are discussed and used to determine the potential of the satellite. "Distant" collisions are discussed briefly and their importance estimated. (auth)

13816
STANDARD ELEMENTS. B. Blanc (Centre d'Etudes Nucléaires, Saclay, France). Vide No. 75, 135-41(1958) May-June. (In French)

Personal experience is cited to point out the various advantages, especially in the laboratory, of having prefabricated vacuum-line components at one's disposal. (auth)

13817
IMPROVEMENTS IN OR RELATING TO SELF LUBRICATING BEARINGS. Alan Blainey (to United Kingdom Atomic Energy Authority). British Patent 833,332. Apr. 21, 1960.

A method is given for coating surfaces with a lubricating layer. First, a suspension of 2 μ Zr particles is applied, dried, and heated to 900°C. After cooling, polytetrafluoroethylene is painted on and baked at 400°C for 10 minutes. (T.R.H.)

13818
MEANS FOR MINIMISING THE ESCAPE OF A GAS OR VAPOUR IN ATOMIC FORM FROM A CASING IN WHICH IT IS PRODUCED. William Joseph Scott (to British Thomson-Houston Company, Ltd.). British Patent 833,427. Apr. 27, 1960.

An arrangement for electric discharge devices containing hydrogen is described for preventing hydrogen loss. Borosilicate glass shields recombine H atoms to H_2 molecules and a return path to the main enclosure is provided. Shields of Fe, Ni, Pt, and Pd may also be used. Unvented cavities in which H atoms recombine and build up pressure are avoided by several techniques. (T.R.H.)

Heat Transfer and Fluid Flow

13819 MIT-NSL-TR-393
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
AN INVESTIGATION OF POROUS WALL COOLING. Richard P. Bernicker. June 1959. 65p. Contract AF49(638)-245. (AFOSR-TN-59-873).

Equations are developed to describe the thermal exchange when a coolant is forced through a heated porous wall, and solutions are obtained on the basis of a simplified model consisting of identical cylindrical channels replacing the actual capillary-like passages. The solutions depend upon Reynolds and Prandtl numbers, geometric parameters involving wall porosity and pore size, and Nusselt number. Experiments were performed with one family of porous materials, and Nusselt numbers were correlated in terms of Reynolds and Prandtl numbers, and porosity. Nusselt number varies almost linearly with Peclet number. Temperature distributions obtained indicate a very small difference between solid and coolant temperatures at the exit surface. (auth)

13820 NAA-SR-4927
Atomics International Div., North American Aviation, Inc. Canoga Park, Calif.
A NEW METHOD FOR DETERMINING THE STABILITY OF TWO-PHASE FLOW IN PARALLEL HEATED CHANNELS WITH APPLICATIONS TO NUCLEAR REACTORS. J. H. Bick. May 1, 1960. 15p. Contract AT-11-1-GEN-8. OTS.

A method is derived for determining whether a particular set of flows through a system of parallel channels is stable and the changes in them when instability occurs. A criterion is derived to determine if a particular reactor is subject to "boiling disease." (auth)

13821 NP-8647
Princeton Univ., N. J. Forrestal Research Center.
PROJECT SQUID. Semi-Annual Progress Report for October 1, 1959 to March 31, 1960. Apr. 1, 1960. 112p. Contract Nonr-1858(25).

Activities in a coöperative program of basic research conducted at 15 laboratory facilities are described. Investigations in fluid mechanics included those on nonsteady flow, turbulence, and magnetohydrodynamics. Other research is reported on elementary reactions in combustion, high-temperature reactions, surface-catalyzed atom and free radical reactions, reaction kinetics in high-temperature gases, and inelastic molecular collisions. Basic research on aspects of combustion phenomena such as solid-propellant flame mechanisms, ignition by hot gases and electric sparks, transport properties at high temperatures, ionization in detonation waves, total radiation from burning solid propellant strands, turbulent flame thermometry, and plasma flow in nozzles are also reported. (J.R.D.)

13822
HEAT TRANSFER IN LAMINAR FLOW BETWEEN PARALLEL PLATES AT SMALL PÉCLÉT NUMBERS. H. C. Agrawal (Indian Inst. of Tech., Kharagpur). Appl. Sci. Research 9A, 177-89(1960). (In English)

The problem of heat transfer for laminar flow between two infinite parallel plates, $y = \pm 1$, $x \leq 0$, kept at a constant temperature T_0, and $y = \pm 1$, $x \geq 0$, kept at a different constant temperature T_s is formulated to take into account the effect of heat diffusion on the incident fluid. This has been achieved by obtaining solutions of the energy equation for the regions $x \leq 0$ and $x \geq 0$ and by imposing continuity conditions on the temperature and its derivative at the junction $x = 0$. It is found that at small Péclét numbers the incident temperature is affected by the diffusion of heat from the right ($x > 0$) to the left ($x < 0$). This effect is negligible for large Péclét numbers ($Pe \sim O(1000)$). Further the temperature of the incident fluid at $x = 0$ cannot be taken as constant ($= T_0$) if the heat generated by viscous dissipation is taken into consideration. Detailed solutions are given for $Pe = 1$. Mean-mixed temperatures and local Nusselt numbers for $x > 0$ and $x < 0$ are tabulated and shown graphically. (auth)

13823
HEAT TRANSFER BY LAMINAR FLOW FROM A ROTATING SPHERE. S. N. Singh (Indian Inst. of Tech., Bombay). Appl. Sci. Research 9A, 197-205(1960). (In English)

The heat transfer problem for the flow of an incompressible viscous, heat-conducting fluid, due to uniform rotation about a diameter of a sphere, which is kept at a constant temperature, has been solved with viscous dissipation included. Due to inflow at the poles the cooler liquid is drawn from infinity towards the rotating sphere and this causes a lowering of the temperature there. After flowing in the boundary layer of the sphere the liquid gets heated up and causes a rise in temperature near the equator. Numerical results are given in case of water, and it is found that the isothermals are surfaces of revolution flattened at the poles and elongated near the equator. The thermal and the velocity boundary layers turn out to be of the same order of magnitude. (auth)

13824
CALCULATION OF COOLANT CHANNEL FACTORS FOR NUCLEAR REACTOR FUEL ELEMENTS. PART II. J. Clauss (Kohlenscheidungs-Gesellschaft m.b.H., Stuttgart). Atomkernenergie 5, 128-34(1960) Apr. (In German)

A continuation is presented of the calculation described in Nuclear Science Abstracts, Vol. 14, abstract No. 9573. The treatment is extended in sections entitled: coolant distribution, channel tolerances, parallel flow, transverse flow, eccentricity factor, fuel density factor, volume factor, concentration factor, uncertainty in the determination of thermal conductivity, boundary influence factors, and the total factors. (T.R.H.)

13825
A NUMERICAL METHOD FOR CALCULATION OF REACTOR COOLING CHANNELS WITH ANY HEAT SOURCE DISTRIBUTION IN THE FUEL ELEMENT. W. Strewe (Technische Universität, Berlin). Atomkernenergie 5, 134-41(1960) Apr. (In German)

If the thermal emission distribution of a fission product element is merely given as the result of measurements in the form of a table or diagram, then it is impossible to calculate the development of the cooling system temperature and that of the surface area of the fission element. In these cases, a procedure is suggested which enables one to estimate numerically the temperature variations with only a few calculations. If entrance and exit temperature of the cooling medium as well as the maximum surface area temperature of the fission element are given, the procedure makes it possible to determine the appropriate values for the lay-out of the cooling channel. The procedure is developed for the simple case where the thermal transition from the cooling medium to the moderator can be disregarded, and also in consideration of the thermal transition to the moderator. Examples illustrate the respective calculations. An evaluation of the errors of this method is given in conclusion of the investigation. (auth)

13826
LOCAL AND MEAN HEAT TRANSFER TO QUIESCENT WATER FLOWING TURBULENTLY IN A TUBE SUBJECT TO A LARGE HEAT LOADING. V. V. Yakovlev. Atomnaya Energ. 8, 250-52(1960) Mar. (In Russian)

The experiments were carried out with a copper tube ($d = 6.7$ mm, $l = 540$ mm) heated by a-c current. The temperature distribution along the tube is tabulated. The water temperature in the tube was determined with a differential thermocouple. Measurements of the local heat-exchange coefficient in the tube are presented as coördinates $Nu_x/C_x \, Pr_x^{0.36} \times (Pr_x/Pr_{cx})^{0.11}$ and Re_x. (R.V.J.)

13827
TEMPERATURE FLUCTUATIONS CAUSED BY TURBULENCE IN A FLOW OF LIQUID. V. I. Subbotin, M. Kh. Ibragimov, and M. N. Ivanovskiĭ. Atomnaya Energ. 8, 254-7(1960) Mar. (In Russian)

The temperatures of flowing liquids were measured with movable thermocouples with open junctions 0.2 mm in diameter and hooded junctions 0.5 to 0.8 mm outside diameter. The experiments showed that recorded temperature fluctuations are induced by temperature pulsation in turbulent flow. Heat transfer pulsations adjacent to the wall and temperature fluctuations at the wall itself indicate that heat transfer through the wall layer is not constant. The thermocouples reacted to fluctuations in a wide range of frequencies (up to 100 Hertz) with practically no amplitude distortion. The recorded amplitudes do not describe the entire temperature pulsation spectrum and should be followed up by studies with perfected instruments. (R.V.J.)

13828

BOUNDARY CONDITIONS CONTROL RESULTS IN UNSTEADY-STATE HEAT TRANSFER. [PART] II. Sam H. Davis, Jr. and William W. Akers (Rice Inst., Houston, Tex.). Chem. Eng. 67, No. 10, 151-4; 156(1960) May 16.

Differential equations are given for problems of unsteady heat conduction through a solid phase and can be used to solve for: (1) temperature distribution in the walls and tubes of heat exchangers, (2) heat loss or gain of a fluid from solids in cyclic operations such as in regenerative heat exchangers, and (3) influence of wall heat capacity on control characteristics of chemical equipment. For certain boundary conditions these equations can be solved for one-dimensional problems, e.g., heat conduction in a thick wall and immersion of a solid in a fluid of different temperature. Application is made to the special case of keeping an oil at 200°F or more in an insulated tank originally at 70°F. (D.L.C.)

13829

NATURAL-CIRCULATION BOILING REACTOR WITH TAPERED COOLANT CHANNELS. S. G. Bankoff (Rose Polytechnic Inst., Terre Haute, Ind.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 113-16(1959).

Tapered coolant channels are suggested as a means of improving the heat transfer characteristics of natural-circulation boiling reactors. A flow model for straight channels is used to predict frictional losses in tapered channels with uniform and with cosine heat-flux distributions. The ratio of the predicted frictional pressure drop in a straight channel to that of an equivalent tapered channel exhibits, as the angle of taper is varied, a rather sharp maximum at a value substantially greater than unity. (auth)

13830

TRIAL MANUFACTURE OF AN EXPERIMENTAL NaK SYSTEM. Y. Imai, K. Fukushima, and T. Ishizaki (Tôhoku Univ., Sendai). J. Atomic Energy Soc. Japan 2, 127-35(1960) Mar. (In Japanese)

From the results of static corrosion experiments, it was found that the stainless steels of types 304, 316, 347, and LCN155 can be used successfully as container materials for NaK. The present investigation was carried out to confirm the safe use of such materials under conditions of dynamic corrosion as well as to get information on the technical difficulty in manufacturing an experimental NaK system. A system was designed to operate up to approximately 600°C with type 347 stainless steel as piping. Heat was supplied by electric heater and removed by air cooler. A regenerative heat exchanger was provided to reduce the required power input; the pump used was of the a-c Faraday type. In this system, NaK was circulated at the rate of about 100g/sec, measured by d-c electromagnetic flow meter. An expansion tank and a sump tank were also provided. "Resistance-type" and "impedance-type" level indicators were used successfully. Wetting of the pipe surface was found to affect both the heat transfer of heat exchanger and the output voltage of the flowmeter. Wetting can be attributed to the reduction of oxides and precipitation of materials (oxide or others) on the pipe surface. (auth)

13831

TEMPERATURE DISTRIBUTIONS IN CYLINDRICAL PLAIN-CANNED FUEL ELEMENTS UNDER SOME TRANSIENT CONDITIONS. R. E. Strickland (Imperial Coll. of Science and Tech., London) and M. Angelopoulos (Technical Univ., Athens). J. Nuclear Energy, Pt. B. Reactor Technol. 1, 161-6(1960) Mar.

Two critical requirements in the design and operation of natural uranium reactors are the maintenance at all times of the maximum fuel temperature below 600°C, the phase change value, and the limiting of the temperature of the can to a value such that its strength and corrosion-resistance properties are adequate. It is necessary, therefore, to examine temperature distributions in the fuel and can under possible significant transient conditions. Three such conditions are numerically examined using the experimental heat transfer data of Hughes and Slack (1958). In two cases, namely, the temperature response to a step change in flux and to a typical flux control disturbance, the results show the time-lag effect due to the dominant time constant which has a characteristic value for each fuel-plus-can system. In the third case, the maximum temperature reached during fuel element charging under load is examined. (auth)

13832

LOSSES INCURRED IN TURNING A GAS FLOWING IN AN ANNULAR DUCT BACK INTO THE CENTRAL TUBE. F. Cheers (Univ. of Manchester, Eng.). J. Nuclear Energy, Pt. B. Reactor Technol. 1, 173-6(1960) Mar.

Tests were carried out to determine the effect of the geometrical arrangement on the losses incurred in turning a fluid from an annular duct back into the central passage. It is shown that if the layout is well chosen, the losses need not be much greater than those for a sudden contraction of the same area ratio. (auth)

13833

DESIGNING BOILERS FOR GAS-COOLED REACTORS. B. G. Ediss (Nuclear Power Plant Co., Ltd. [London]). Nuclear Power 5, No. 49, 101-4(1960) May.

Considerations for the design of heat exchangers or boilers for gas cooled reactors are discussed and it is shown that adaptation of standard methods of heat exchange design simplifies considerably the calculations. An equation for the rationalization of banks of finned tubes is used for the investigation of the variation of the heat exchange matrix with the arrangement of a given tube. Graphs of the design variables vs. the pressure drop of the coolant gas are given and used to finalize the design. (D.L.C.)

13834

CURRENT SIMULATES FISSION HEAT IN FUEL-ELEMENT TEST LOOP. P. E. Bissonnette and J. B. Carr (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 18, No. 5, 110; 112; 114-15(1960) May.

A system is described which is used to determine the heat-transfer and fluid-flow characteristics of proposed fuel designs. The tests are facilitated by the lack of radiation in a 2,500 psi 650°F water flow loop, in which 1.2 Mw of fission heat is simulated by d-c power passing through the test elements. The loop consists of primary and secondary closed cooling systems. The heat is transferred from the primary by seven parallel heat exchangers to the secondary system. From the secondary system, the heat is transferred to the Mohawk river by means of two shell-and-tube heat exchangers. The loop is shut down only to change test sections or to make repairs to minimize the number of thermal shocks and extend equipment life. Fail-safe interlocks are incorporated in the primary system to protect the loop from damage under dangerous operating conditions. (B.O.G.)

13835

ELECTROMAGNETIC INTERACTION WITH AERODYNAMIC FLOWS. E. L. Resler, Jr., and J. E. McCune (Cornell Univ., Ithaca, N. Y.). p.120-35 of "The Magnetodynamics of Conducting Fluids." David Bershader, ed. Stanford, Calif., Stanford University Press, 1959.

A brief discussion of some recent developments in linearized magneto-aerodynamics is presented with emphasis on the interaction parameters of electric and magnetic fields. Steady flows in two dimensions, around wavy walls, and around thin airfoils are considered. Conditions for the solution of the linearized magneto-aerodynamic equations are given for each case. (D.L.C.)

Instrumentation

13836 ARF-1151-5

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MAGNETIC RECORDER FOR NUCLEAR PULSE APPLICATION. Period covered: February 6 to April 5, 1960. G. M. Burgwald and R. M. Norton. Apr. 15, 1960. Contract AT(11-1)-702. OTS.

The accuracies which can be achieved in analog recording systems are for the most part tape limited. While reasonable variations in tape speed do not directly affect the accuracy, such variations result in improper tape tensioning, which in turn results in poor head-to-tape contact. The quality of the tape transport mechanism should be such that the error introduced by improper head-to-tape contact is less than tape errors. Some additional equipment is necessary in setting up a tape recorder for a given experiment. The amplitude of the input pulse spectrum to the recorder should be adjusted for optimum value and, if possible, the counting rate should be adjusted to obtain good tape utilization. An oscilloscope is probably adequate to satisfy both conditions. (auth)

13837 CERN-60-8

European Organization for Nuclear Research, Geneva.

A TRANSISTORIZED CIRCUIT FOR LIMITING AND SHAPING THE INPUT PULSES TO A FAST COINCIDENCE CIRCUIT. C. M. York. Mar. 16, 1960. 9p.

A transistorized version of a pulse limiting-shaping circuit is described. The results of a test carried out under experimental conditions are also included. (J.R.D.)

13838 CNI-30

Italy. Comitato Nazionale per le Ricerche Nucleari. Centro di Studi Nucleari, Ispra.

ALPHA-PULSE ANALYSIS BY SCINTILLATION DETECTORS. G. Bertolini, A. M. Del Turco, and G. Restelli. Dec. 1959. 13p.

The light output of CsI(Tl), NaI(Tl), and plastic crystals to alpha particles of 4.68, 5.3, 5.8, 6.05, and 8.78 Mev was investigated and the resolutions for the 5.3 Mev line of Po^{210} were respectively found to be 4.5, 5, and 5.5%. The relative efficiency to alpha and beta particles and the pulse height as a function of the energy is given. The branching ratio $\alpha/\alpha + \beta$ of ThC was determinated by the CsI(Tl) and found equal to 0.358 ± 0.003. (auth)

13839 CWLR-2378

Chemical Warfare Labs., Army Chemical Center, Md.

A PORTABLE LOW-LEVEL ALPHA COUNTER FOR FIELD USE. Arthur Lind and John C. Goshorn, Jr. Mar. 1960. 14p.

A proportional-probe alpha-survey meter (Nuclear Chicago model 2111) has been modified into an enclosed-chamber-type alpha counter, using a multiplier-phototube, alpha scintillator, and a housing designed to accept swipes. The modified instrument is both reliable and sensitive enough to detect very low levels of alpha contamination. The major improvement in reliability is the elimination of the air probe which was subject to high-voltage leakage and microphonics. (auth)

13840 HW-64258

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

GLOVE BOX INTEGRITY STUDY. R. A. Ciccarelli. Mar. 8, 1960. 23p. Contract AT(45-1)-1350. OTS.

A program is described which was designed to determine the leak rates for drybox neoprene gloves, plastic posting bags, and sphincter seals. An evaluation of a self-sealing weather strip molding as an alternate method of mounting window panels is also given. Conclusions regarding component in leakage are discussed and recommendations for design of test instrumentation and steps to minimize in leakage are included. (J.R.D.)

13841 JPLAI-LS-57

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

MASERS. Astronautics Information Literature Search No. 57. Edda Barber. Feb. 15, 1960. 35p. Contract NASw-6.

The material available in the library of JPL on the subject of gas and solid state masers was covered. Reports and journal items are cited through 1959. Abstracts are given for most of the references. (W.D.M.)

13842 LS-66

Israel. Atomic Energy Commission, Tel-Aviv.

LITERATURE SURVEY ON DETECTION OF NEUTRONS BY SCINTILLATORS. Aug. 1959. 13p.

A bibliography is presented on neutron detection by scintillation counters. The references were obtained from research reports, Nuclear Science Abstracts 1948 through issue No. 11, 1959, and other bibliographies. 144 references. (T.R.H.)

13843 NP-8602

New York Naval Shipyard, Brooklyn.

RESPONSE OF VARIOUS RADIATION DETECTOR TYPES IN AN ATMOSPHERE OF XENON-133. Progress Report No. 7. Thomas I. Monahan. Nov. 4, 1959. 16p. Lab. Project 5315-85.

The response characteristics of twelve G-M tubes and a film badge were studied in a confined atmosphere contaminated with Xe^{133}. The types tested were 5979/BS-1, EP-74, Anton 232, TGC-1, Anton 1008, Victoreen AN/PDR-51, RCL 10301, and RCL 10302, and a KAPL film badge. The detectors were located in a 40-cm cube in the center of an 8-ft room. The results are tabulated and discussed. (T.R.H.)

13844 NP-8668

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PARASITIC MULTIPLE BRAGG SCATTERING IN THE NEUTRON CRYSTAL SPECTROMETER. Report No. 134/I-B. D. O'Connor and J. Sosnowski. Jan. 1960. 17p.

Nuclear reactor slow neutron spectra obtained by the use of a crystal monochromator contain a number of irregular fluctuations in the form of inverted peaks due to fluctuations in the reflectivity of the crystal. It is shown that these fluctuations are due to Bragg reflection of neutrons by reflecting planes other than that used to obtain the monochromatic beam. Approximate formulas are derived for the magnitude and half-width of these inverted peaks for a mosaic crystal. Experiments carried out with copper and aluminum single crystals confirm that the Bragg angles at which the peaks occur depend on the type of crystal structure and not on the lattice constants. The measured depth of the better defined peaks was in satisfactory agreement with that calculated on the basis of the approximate formulas. A comparison of the measurements with the crystals at room and liquid air temperatures failed to reveal the presence of inelastic scattering as a contributory factor to the fluctuations in reflectivity. (auth)

13845 NP-8672
Lockheed Nuclear Products, Marietta, Ga.
A CURRENT INTEGRATOR FOR GAMMA DOSIMETRY. E. N. Lide and H. J. Jarvis. Mar. 1960. 18p. Contract AF33(600)-38947. (NR-81).

An analog computer (Integrating device) was developed to compute the total radiation dose of a test article being irradiated. The circuit employs an electrometer tube connected as a cathode follower to drive an operations amplifier. A standard capacitor is connected from the electrometer input to the amplifier output. All of the current from an ionization chamber flows into the input capacitor; when the voltage across the capacitor reaches a predetermined value, the capacitor is automatically discharged and a count is entered into a mechanical register. Total dose may be read out in terms of counts in the register and fractions of a count from a built-in vacuum tube voltmeter circuit. (auth)

13846 RIB-43
David Sarnoff Research Center, Princeton, N. J.
DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Interim Report No. 10 [for] November 1, 1959—January 31, 1960. J. A. Baicker, A. H. Sommer, T. S. Chen, and G. O. Fowler. 23p. Contract AT(30-1)-1958. OTS.

The design of the high-speed central electrode photomultiplier including the photocathode-to-first dynode system was essentially completed. Time measurements were made on conventional photomultipliers of the types RCA 7264 and C-7260 in order to compare the performance of Lancaster-produced tubes with the laboratory prototypes. Some work has been started to determine whether or not a traveling wave type of output can be used with a high-speed photomultiplier to reduce the very great inefficiency resulting from the present method of taking the signal from the multiplier. The basic causes of dark current pulses in photomultipliers were studied. (For preceding period see RIB-42.) (W.L.H.)

13847 SC-4418(RR)
Sandia Corp., Albuquerque, N. Mex.
A SLIDE RULE TYPE OF DEVICE TO MEASURE LOGARITHMIC DECAY TIMES AS PRESENTED BY OSCILLOGRAPH RECORDS. Rodman N. Leach. Mar. 1960. 17p. OTS.

The longitudinal aerodynamic stability properties of missiles and bombs can be determined by testing scale models mounted in a wind tunnel. The models are allowed to oscillate with a single degree of freedom after an initial displacement from the wind axis. The period of oscillation and the damping of these oscillations, as recorded on oscillograph records, are used to calculate the longitudinal static and dynamic stability coefficients. A device that forms a logarithmic decay envelope of the damping trace using a pair of deflected wires and that can be used to obtain direct readings of damping times and periods of oscillation is described and evaluated. (auth)

13848 SCR-167
Sandia Corp., Albuquerque, N. Mex.
EVALUATION OF PLATED-THROUGH CONNECTIONS FOR PRINTED CIRCUIT BOARDS. George Voida and Norbert J. Eich. Apr. 1960. 32p. OTS.

Concepts of metallizing dielectric surfaces by copper reduction or immersion deposition are discussed. Step-by-step processing techniques for producing quality plated-through connections are described. A description of the tests performed on the plated-through connections is given (C.J.G.)

13849 SCTM-11-56(51)
Sandia Corp., Albuquerque, N. Mex.
THE WIANCKO PRESSURE TRANSDUCER (AN EVALUATION WITH SUGGESTED MODIFICATIONS). E. J. Vulgan. Nov. 8, 1955. 33p. OTS.

Experiments were performed on the Wiancko pressure transducer to achieve better mechanical and acoustical damping and to minimize nonlinearities in transient response. The use of a special damping grease was found to solve the mechanical damping problem. Compactness of the gage was achieved by reduction of size and simplification of mounting the gage canisters. (C.J.G.)

13850 SCTM-45-60(13)
Sandia Corp., Albuquerque, N. Mex.
A CAPACITOR MONITOR FOR HIGH-ENERGY CAPACITIVE STORAGE BANKS. J. L. Todd. Mar. 5, 1960. 17p OTS.

A monitoring system for determining the number of capacitors in a parallel array is described. Circuit equations were derived. (C.J.G.)

13851 SCTM-82-60(14)
Sandia Corp., Albuquerque, N. Mex.
EXPERIMENTAL STUDY OF INVERTED L-, T-, AND RELATED TRANSMISSION-LINE ANTENNAS. Sheila Prasad and Ronold W. P. King. Mar. 3, 1960. 55p. OTS.

An experimental study of inverted L-, T-, and related transmission-line antennas is described. The impedances were measured for L-antennas of total electrical length $\beta(h + l)$ equal to π and $\pi/2$ and for T-antennas of electrical length $\pi/2$ (height plus one element of the top load). Other structures studied were antennas of two-, three-, and four-element top loads. The apparent measured impedance was corrected for the coaxial line driving the antenna over a ground plane. For small heights, the antennas behaved like transmission lines over a ground plane. The capacitive end correction was used to correct end effects at the open end of the transmission-line antenna and approximate theoretical impedances were calculated for small heights which could not be measured experimentally. The transmission-line antennas studied were of three types: (1) the shunt-driven transmission line with open and closed ends, (2) the shunt-driven transmission line with two closed ends, and (3) the end-driven section of transmission line with a closed end. The capacitive and inductive end corrections were made. The impedance of the hairpin antenna was obtained experimentally. (auth)

13852 SCTM-214-59(12)
Sandia Corp., Albuquerque, N. Mex.
ZEUS FIRING SYSTEM. J. A. Johnson. Mar. 1960. 10p. OTS.

The firing system used to trigger the 1344 switch ignitrons of an energy storage bank (ZEUS) which is used in controlled thermonuclear research is discussed. Diagrams of the firing circuit are contained. (C.J.G.)

13853 SCTM-241A-59(51)
Sandia Corp., Albuquerque, N. Mex.
THEORY OF AN ELECTROSTATIC ENERGY SUPPLY; ANALYSIS OF NONDESTRUCTIVE METHODS FOR THE MEASUREMENT OF INTERNAL CHARGES. H. G. Baerwald. Mar. 28, 1960. 89p. OTS.

Physical background, analysis, and tentative design of a type of electrostatic energy supply based on charge embedment in insulators are discussed. A class of electromechanical dynamic methods for use in nondestructive measurement of entrapped charges is proposed and analyzed in detail. (auth)

13854 SCTM-364-59(16)
Sandia Corp., Albuquerque, N. Mex.
AUTOMATIC READOUT SYSTEM BERKELEY TO GALVANOMETER. C. M. Warthen. Nov. 20, 1959. 16p. OTS.

An automatic readout system is described which will reproduce on an oscillograph record the count information displayed by an EPUT (events per unit time) meter. By employing two oscillograph galvanometers, the system can display both the count interval (time during which the meter is collecting the count information) and the display interval (time during which the meter is displaying digits) of the meter. The practical maximum paper speed for the oscillograph used with the readout system is 50 in./sec. An accessory chassis is available which will allow the recording of single counts. (auth)

13855 SCTM-377-59(12)
Sandia Corp., Albuquerque, N. Mex.
A SANDIA PROTOTYPE SYSTEM OF THE ZEUS CAPACITOR BANK. R. D. Aden and H. E. Morris. Jan. 6, 1960. 15p. OTS.

A description of a prototype system of the Zeus capacitor bank is given, including the rectifier system and the control room. The system developed to control the prototype capacitor bank and charging supply is discussed and a signal flow diagram presented. (C.J.G.)

13856 SCTM-431-58(14)
Sandia Corp., Albuquerque, N. Mex.
THE APPLICATION OF SUPER-REGENERATION TO UHF. R. L. O'Nan. Jan. 9, 1959. 34p. Contract AT(29-1)-789. OTS.

It is shown how the parameters of a quarter-wave section of transmission line, which is used as the resonant circuit in the UHF band of frequencies, can be used to determine the equivalent values of the lumped capacitance and the quiescent capacitance of the circuit, and the resulting conductance when the tube is active. (auth)

13857 TID-5793
Picker X-Ray Corp. Picker Research Center, Cleveland.
RADIOISOTOPE X-RAY GENERATOR. Quarterly Progress Report No. 3 covering the Period from January 1, 1960 to March 31, 1960. M. W. Chisholm, R. J. Lambert, and Jacob Kastner. 10p. Contract AT(11-1)-746. OTS.

Quadrupole magnetic lenses were tested for proper field distribution and were used to study the focusing of beta rays from a 50-mc sealed source of Sr^{90}. Preliminary observations lead to the conclusion that focusing was achieved. (For preceding period see AECU-4632.) (J.R.D.)

13858 USASRDL-TR-2070
Army Signal Engineering Labs., Fort Monmouth, N. J.
IRRADIATION OF SEMIRAD AT THE GENERAL ATOMIC LINEAR ACCELERATOR (LINAC), MAY 5, 1959. Stanley Kronenberg and Harry M. Murphy, Jr. Sept. 1, 1959. 19p.

The experiment described is one which SEMIRAD instruments were irradiated with short bursts of gamma radiation. The purpose of the experiment was to determine SEMIRAD response to radiation pulses of less than $10\text{-}\mu$sec duration. SEMIRAD instruments were exposed to the radiation source, and signals from the SEMIRAD were transmitted to a triggered oscilloscope and the traces photographed. The SEMIRAD response demonstrated that the time resolution was on the order of 10 mμsec or less. An interesting side effect was observed, viz., secondary-electron energies of >300 volts were noted. These high-energy secondary electrons are as yet unexplained. (auth)

13859
MEASUREMENT OF THIN METAL LAYERS. FLUORESCENT X-RAY PRODUCTION BY RADIOISOTOPE SOURCES. G. B. Cook, C. E Mellish, and J. A. Payne (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chem. 32, 590-3(1960) May.

The use of radioactive isotopes for simple x-ray fluorescence spectroscopy, and in particular for the measurement of thin films, is not new. It is shown that the method can have fairly wide application to the measurement of thin films of many elements, and that there is a choice of the thickness range in which the method is sensitive. The potential flexibility of the method is partly in the fact that there are three different ways of applying it—by using K x-ray excitation, L x-ray excitation, and absorption of x-rays excited in the base metal—and partly in the different response that can be obtained by varying the radioactive source used. To illustrate these general points, measurements on chromium, tin, and copper plate are reported and discussed. Limitations of the method are also discussed. (auth)

13860
PYROLYSIS AS AN ANALYTICAL TOOL. R. N. Rogers, S. K. Yasuda, and John Zinn (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 32, 672-8(1960) May.

A new, simple type of instrument for measuring the thermal conductivity of evolved gases is proposed to replace the thermobalance. Pyrolysis curves of organic and inorganic compounds approximate the first derivative of the thermogravimetric pyrolysis curve. A theoretical discussion indicates how pyrolysis data may be used to obtain kinetic constants. A number of organic and inorganic pyrolysis curves are presented. (auth)

13861
ION SOURCE FOR ISOTOPE ANALYSIS OF ELEMENTS. W. Zuk (M. Curie-Sklodowska Univ., Poland). Ann. Univ. Mariae Curie-Sklodowska, Lublin-Polonia, Sect. AA 11, 13-21(1956). (Translated from Referat. Zhur. Khim. No. 16, 1959, abstract No. 56981).

An ion source for a mass spectrometer which can be used in the isotope analysis of both gaseous and low-vapor-pressure liquid elements is described. The source is equipped with an electrically heated vaporizer of 30-mm^3 capacity. The vaporizer block is equipped with a tapered ground glass joint which makes it possible to change the sample without removing and taking apart the entire source. Data on the operation of the source in the analysis of PbS are given.

13862
PARALLEL-PLATE COUNTER WITH ELECTRONICALLY TRIGGERED SPARKING FOR PARTICLE TRAJECTORY

DETERMINATION. J. Trümper (Universität, Kiel). Atomkernenergie 5, 121-8(1960) Apr. (In German)

A telescope consisting of parallel plate counters for determining the trajectories of high energetic particles in cosmic rays is described. The counters operate just below the static breakdown voltage. In the case of a coincidence the counters are triggered by a high voltage pulse. The sparks are recorded photographically. By operating the counters in this way the lifetime is longer than of those counters which operate always in the spark region. Moreover it enables a bigger surface area of the counters to be used. The telescope may be triggered by a G.M.-coincidence. The error of determining the position of the particle in the counter is 0.2 mm. The efficiency for weakly ionising particles is 96%. A counter has a scattering layer of 0.04 g/cm^2 Al. (auth)

13863

GAMMA-RAY DOSIMETRY BY MEANS OF THE CHANGES IN OPTICAL ACTIVITY IN CERTAIN HYDROCARBONS. S. V. Starodubtsev, Sh. A. Ablyaev, and V. V. Generalova. Atomnaya Energ. 8, 264-5(1960) Mar. (In Russian)

The action of intense γ beams on aqueous solutions of saccharose and glucose was investigated. Distilled water solutions were irradiated with a 2100-c Co^{60} source to a maximum dose of 1.1 Mr/hr. Polarization plane rotation was considerably reduced in both. Moreover, the rotation angle, measured in a range up to 200 Mr, changed linearly with dose. The effect does not depend on the dosage rate within 10^4 to 10^6 r/hr and the results are reproducible. The simplicity of the experiment, its wide range of dosage (up to 10^8 to 10^9 r), and its independence of dosage recommend its use in dosimetry. (R.V.J.)

13864

LIQUID SCINTILLATION COUNTING OF RADIOAUTOGRAMS. John W. Geiger and Lemuel D. Wright (Cornell Univ., Ithaca, N. Y.). Biochem. Biophys. Research Commun. 2, 282-3(1960) Apr.

Counting procedures are described for the liquid scintillation counting of paper sections from radioautograms. (C.H.)

13865

INTEGRATOR FOR MEASURING IONOSPHERIC RADIOWAVE ABSORPTION. B. P. Potapov and Z. Ts. Rapoport. Elektrosvyaz 14, No. 2, 28-31(1960) Feb. (In Russian)

Descriptions are given of an anode-grid capacity integrator adapted to an installation for measuring radiowaves in the ionosphere. (R.V.J.)

13866

THE DESIGNING AND FABRICATION OF REMOTE HANDLING GEAR FOR BETA-ACTIVE MATERIALS. Jozsef Hirling (Csepel Iron and Steel Works, [Hungary]). Energia és Atomtech. 12, 181-2(1959) Feb.-Mar. (In Hungarian)

Mechanical descriptions, a photograph, and five sketches are given of a small manipulation chamber and its remote handling gear. The chamber is made of Plexiglas. The front wall is 20 millimeters thick; the sides and slant top, 10 millimeters. The walls can be lined with lead bricks if shielding against gamma radiation is desired. The front wall has two glove ports. The four remote handling rods (two in front and one on each side) are installed in spherical lead sockets that permit rotation in a maximum angle of 60 degrees in any direction. Five pairs of jaws and two types of pistol grips (one contracts, the other releases the jaws when the triggers are pressed) are illustrated. The jaws are chromium plated to prevent corrosion by decontamination. (JPRS)

13867

VARIABLE ORIFICE FLOWMETERS GO LINEAR. Ernest C. Evans (Oak Ridge Gaseous Diffusion Plant, Tenn.). ISA Journal 7, No. 5, 91-3(1960) May.

A variable orifice designed in such a way that flow is a linear function of the orifice opening would be desirable as a flow element for recording or control of flow. Such an orifice is described with accompanying drawings; it consists of a slit with the length much longer than the width and a slider which determines how much of the slit length is uncovered. The model was tested at several different forepressures and critical flow with dry air, and the flow was found to be linear with respect to slit length almost down to total slit closure. The pressure ratios (P_f/P_b) necessary to maintain critical flow at 0.1 and 1.0% change in P_f were determined for several forepressures and slit lengths. (D.L.C.)

13868

MAGNETIC INDUCTION METERS BASED ON HALL EFFECT. S. G. Taranov and N. E. Fevraleva. Izmeritel'naya Tekh. No. 2, 33-5(1960) Feb. (In Russian)

A device based on the Hall effect in semiconductors was designed for use as an induction meter for magnetoelectrical apparatus. (R.V.J.)

13869

SMALL-SIZE RADIOMETER WITH ELECTRIC GENERATOR. B. Z. Votlokhin. Izmeritel'naya Tekh. No. 3, 38-9 (1960) Mar. (In Russian)

Descriptions are given of a pocket-size battery-operated dosimeter for γ and strong β radiation. The order of accuracy for γ radiation is 25%. (R.V.J.)

13870

MAGNETIC γ SPECTROMETER WITH "ANNULAR" FIELD. A. S. Karamyan and P. T. Prokof'ev. Izmeritel'naya Tekh. No. 3, 39-41(1960) Mar. (In Russian)

The construction and performance of a magnetic spectrometer for measuring γ ray spectra at 200 to 700 kev, using the characteristic angular distribution of photoelectrons, are described. (R.V.J.)

13871

ON THE PROBLEMS IN CALCULATIONS OF MOVING CURRENTS IN ION COUNTER MEASURING CONDENSERS AND IN ION COUNTERS. N. N. Komarov (Inst. of Applied Geophysics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 2, 309-17(1960) Feb. (In Russian)

Formulas are derived for calculating unstable current in cylindrical and plane condensers. The derived formulas are correlated with the formulas for ohmic and saturation currents. Parameters for determining condenser inertia under various types of operation are analyzed. (R.V.J.)

13872

IONIZATION DETECTOR FOR GAS CHROMATOGRAPHY: A MODIFICATION WITHOUT RADIATION SOURCE. E. Haahti, T. Nikkari, and E. Kulonen (Univ. of Turku, Finland). J. Chromatog. 3, 372-3(1960) Apr. (In English)

A modification of Lovelock's ionization detector without a radiation source is described. It is made of two parts joined by a glass joint to facilitate cleaning of the chamber. The response of the detector is given for methyl laurate and a Celite 545-Apiezon L grease column at 180°C with an Al plate or a Sr^{90} source as the anode. It is seen that the absence of the Sr^{90} source decreases considerably the basic ionization current and improves the stability and noise level while keeping the sensitivity the same. (D.L.C.)

13873

LUMINESCENT GLASSES FOR USE IN THE DETECTION OF NUCLEAR RADIATION. D. G. Anderson, J. Dracass, and T. P. Flanagan (British Scientific Instrument Research Assn., Eng.). J. Electronics and Control (1) 7, 463-4(1959) Nov. (In English)

Glass for scintillators has the advantages of high density, durability, size limited only by the size of the melt, and possible alteration of shape by conventional glass-working techniques. Clear colorless luminescent glasses with cerium as activator were prepared, and their conversion efficiencies were found to be about 12% compared with a standard NaI(Tl) crystal. The procedure for measuring the efficiency is described briefly. If lithium is included in the glass composition, thermal neutrons and α particles can be detected; by a suitable choice of shape, strong backgrounds of β or γ radiation can also be corrected. The energy from the excited glass has a maximum at the wavelength 0.42 μ, and its decay time is on the order of 10^{-7} sec. Other possible applications of glass scintillators are given. (D.L.C.)

13874

CONSTRUCTION OF A CHRONOTRON FOR MEASUREMENT OF TIME-OF-FLIGHT OF FAST NEUTRONS. J. Duclos (Université, Grenoble, France). J. phys. radium 21, Suppl. to No. 3, 19A-23A(1960) Mar. (In French)

A chronotron using the storage circuits of a 100-channel amplitude analyzer is described. A time expansion is obtained by an arrangement of 6BN6 tubes. The width at half maximum of the prompt coincidence curve is 7×10^{-10} s for γ-γ coincidences from Co^{60} and 2×10^{-9} s for n-α coincidences from the (d, t) reaction. (auth)

13875

REMARKS ON CONSTRUCTION OF SCINTILLATION CHAMBERS. J. Duflo (Collège de France, Paris). J. phys. radium 21, Suppl. to No. 3, 65A-8A(1960) Mar. (In French)

Details are given of the construction of a scintillation chamber utilizing refrigerated CsI filaments and a Lallemand-Duchesne electronic camera. The angular distribution of the light emitted by the filaments was studied, and remarks are made concerning possible optical systems to transmit the light from scintillator to camera. (auth)

13876

CONTROL OF INTENSITY WITHOUT DISTORTION. J. Suchet (Compagnie de Saint-Gobain, Paris). J. phys. radium 21, Suppl. to No. 3, 69A-70A(1960) Mar. (In French)

A method is given for controlling the intensity of an alternating current across a resistance load. It is useful with elements of non-linear circuits such as iron-core transformers, Fe-H resistors, and NL or VDR resistors, or with reactive elements which change the phase angle of currents flowing in them. The method consists essentially in inserting an indirectly heated thermistor in series with the variable load. The value of the thermistor is controlled by the energy from its heating winding so that the total resistance of the circuit remains constant. With such a circuit a 1 milliampere current was controlled to ±1% with a load variation of 0 to 6000 ohms. (T.R.H.)

13877

ADDED NOTE ON SCINTILLATION CHAMBERS. J. Duflo (Collège de France, Paris). J. phys. radium 21, Suppl. to No. 3, 70A(1960) Mar. (In French)

An optical system with magnification less than one is suggested as an improvement for transmitting scintillation light to the camera. (T.R.H.)

13878

GERMANIUM CRYSTAL AS A NEUTRON MONOCHROMATOR AND THE DETERMINATION OF ITS HIGHER ORDER CONTAMINATIONS. John T. Wajima (Hitachi, Ltd., Tokyo) and Brice M. Rustad and Edward Melkonian (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). J. Phys. Soc. Japan 15, 630-41(1960) Apr. (In English)

In order to cover the wave length range 1 ~ 4A with neutron crystal spectrometers, an attempt was made to use as a neutron monochromator a germanium crystal. Germanium has a diamond cubic structure and the second order (2 2 2) reflection is theoretically forbidden. The intensity ratio of third to first order neutrons, I_3/I_1, at thermal energy was determined to be 0.023 ± 0.002 in agreement with the theoretically predicted values, $I_3/I_1 = 0.0245$ and $I_4/I_1 = 0.0055$. A maximum value of 0.2% was also measured for the second order contamination in the same way. The total higher order contamination determined from the transmission of pyrex glass plates was (4.7 ± 0.5)% at thermal energy, assuming only the third order contamination. The comparison of Ge, Si, and NaCl crystals as monochromators is discussed. The experiment indicates the successful use of a germanium crystal in A region as a neutron monochromator and also confirms the ways of determining higher order contaminations. (auth)

13879

NEW METHOD OF SAMPLE INTERCHANGE IN A SOLID-SOURCE MASS SPECTROMETER. B. R. F. Kendall (University of Western Australia, Nedlands). J. Sci. Instr. 37, 130-1(1960) Apr.

An ion source is described in which any one of a number of samples on a single filament can be analyzed at will. The operation of the source is based on the effects of potential variations along the length of the filament. Results obtained and possible applications are discussed. (auth)

13880

LOW-ANGLE GEIGER DIFFRACTOMETER FOR USE WITH MONOCHROMATIC RADIATION. P. W. Teare (Aluminium Labs., Ltd., Banbury, Eng.). J. Sci. Instr. 37, 132-4(1960) Apr.

An x-ray diffractometer was designed to study low-angle scattering from precipitation-hardening aluminum alloys. The problems of design that arise with this type of instrument are discussed, and their practical solution illustrated by the low-angle diffractometer finally built. The performance of the diffractometer is critically reviewed and a table of results given to show the obtainable reproducibility. It is thought possible that proportional counting could greatly improve the diffractometer. (auth)

13881

VACUUM SUBLIMATION APPARATUS FOR PREPARATION OF THIN SOURCES OF α-ACTIVE MATERIALS. N. Jackson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr. 37, 169-71(1960) May.

A method of preparing sources for α-pulse analysis by subliming the oxide at 2000°C from a tantalum filament is described. Sources so prepared gave good uniform resolution with a peak width at half height of 35 kev or less. (auth)

13882

VACUUM FURNACE FOR HIGH TEMPERATURE X-RAY DIFFRACTOMETRY. J. N. Van Niekerk (National Physical Research Lab., Pretoria). J. Sci. Instr. 37, 172-5 (1960) May.

A vacuum furnace in conjunction with an x-ray diffractometer to be used for studying phase changes and solid state reactions at high temperatures is described. The sample is heated, primarily by radiation, from a platinum/20% rhodium heating element. The present temperature range is from room temperature to 1200°C, but a slight modification to the sample holder should allow temperatures of about 1600°C to be reached. Cooling of the furnace jacket is so efficient that simple O-ring principles are used to obtain the desired vacuum conditions. The sample holder is controlled from the outside and can be removed without in any way disturbing the rest of the furnace components. Data on temperature calibration and the experimentally determined inversion temperatures of quartz and iron are given. (auth)

13883

RADIOACTIVITY MEASUREMENT IN WATERS. Jarmila Rálková (Inst. of Nuclear Research, Prague). Jaderná energie 6, 89-93(1960). (In Czech.)

A survey is given of methods of low activity measurement in water. The methods and instruments used till now possess a low efficiency and accuracy or they are too toilsome and sluggish. The instruments designed recently enable a more rapidly and accurately low-activity measurement, but at present they are not produced anywhere in series. This problem needs to be solved. (auth)

13884

A TIME RECORDING APPARATUS FOR THE SIMPLIFICATION OF THE HALF-LIFE DETERMINATION WITH COUNTERS AND TIME TRIGGER. H. Helmberger and W. Dietz (Wacker-Chemie G.m.b.H., Munich). Kerntechnik 2, 90-1(1960) Mar. (In German)

An apparatus is described which simplifies the determination of the half life of radioactive preparations with counters and time trigger. With this time recording apparatus the impression of a measurement value t_M was released in a constant, adjustable time interval, so that one obtains in a simple manner the moment at which the impression of the value registered as t_M occurs. (tr-auth)

13885

THE USE OF POTASSIUM BROMIDE CRYSTALS FOR DOSIMETRY OF GAMMA-RADIATION. V. S. Bubnov, I. B. Keinrim-Markus, and T. N. Smirnova. Med. Radiol. 5, No. 3, 61-4(1960) Mar. (In Russian)

Methods are described for obtaining crystals of KBr-H sensitive to gamma-radiation. Under investigation were the induced adsorption spectra, the dependence of the adsorption coefficient in the F-band maximum upon the gamma dose and the storage time after excitation. It is shown that KBr-H monocrystals can be utilized for the creation of dosimetric marks for visual assessment or photometric determination of gamma dose from 100 to 10,000 r. (auth)

13886

HEALTH PHYSICS INSTRUMENTATION. 2. Denis Taylor (Plessey Nucleonics Ltd., [Northampton, Eng.]). Nuclear Power 5, No. 49, 110-14(1960) May.

The design and limitation of apparatus for use in measurement of radiation exposure are discussed with emphasis on calibration and effects of various factors (proximity of measurer, radiation energy, etc.) on response. The instruments covered include ionization chambers, geiger counters, organic and inorganic scintillation counters, photoconductive crystals, boron neutron counters, and quartz-fiber dosimeters. (D.L.C.)

13887

SCINTILLATORS AND SEMICONDUCTORS. SCINTILLATION THEORY. NEW SCINTILLATORS. PHOTOMULTIPLIER DEVELOPMENTS. RECORDING PARTICLE TRACKS WITH THE LUMINESCENT CHAMBER. Martin L. Perl and Lawrence W. Jones (Univ. of Michigan, Ann Arbor). SEMICONDUCTOR DETECTORS. Nucleonics 18, No. 5, 85-100(1960) May.

The highlights of the Seventh Scintillation Counter Symposium are presented. The reports included information on scintillation theory, new scintillators, photomultiplier development, recording particle tracks, and semiconductor detectors. Present scintillation processes are discussed in an effort to explain low efficiency, crystal response as a function of stopping power, and slow and fast components of pulses from organics. The advantages of improved glasses, neutron-sensitive gases, and CsI as scintillators are discussed. The presentations on the science and technology of photomultipliers show a broad frontal attack on problems that currently limit the usefulness of the tubes. The properties and applications of luminescent chambers are compared to those for other particle track-recording devices. Semiconductor junction detectors, having already outstripped gridded ion chambers for alpha-particle spectral measurements, are shown to have other applications with further development. (B.O.G.)

13888

ION-CHAMBER RESPONSE IN HIGH-LEVEL RADIATION FIELD. E. G. Bylander (General Dynamics Corp., Fort Worth, Tex.). Nucleonics 18, No. 5, 102; 104(1960) May.

An adaptation of an ORNL ion chamber is described. The instrument was modified to meet the criteria set by an Air Force committee for the standardization of radiation measurement techniques. These criteria for satisfactory instrument performance are: (1) as nondirectional as possible; (2) known temperature response between 0 and 100°C; (3) known neutron response as low as possible; (4) capable of withstanding 10^{12} ergs/g (C); (5) sturdy and simple construction; (6) linear to $\pm\frac{1}{2}\%$ at 10^5 to 10^{10} ergs/g (C)/hr. All these were met but the last. The results indicate that the chamber can be used in dose rates up to 4×10^{10} ergs/g (C)/hr with a 5 kv collecting potential at 1,000 mm absolute pressure and a 2×10^{10} ergs/g (C)/hr with 3 kv at 760 mm. (B.O.G.)

13889

CHARACTERISTICS OF FUJI NUCLEAR EMULSION TYPE ET-7A. K. Imaeda (Yamanashi Univ., Kofu, Japan). Nuovo cimento (10) 15, Suppl. No. 3, 374-81(1960). (In English)

The characteristics of the emulsion were investigated with respect to physical properties, particle detection, and particle analysis. The study resulted in an examination of the size of developed grains, specific gravity under atmospheres of different humidity, and stopping power determined by the μ-meson range in π-μ decay. The emulsions were exposed at sea level to Co^{60} γ-rays or Sr^{90} electrons, at Mt. Fuji (3,776 meters) for 35 days, and at 30,000 meters for six hours by free balloon. The results of the investigation are discussed. (B.O.G.)

13890

EFFICIENCY IN AREA-SCANNING FOR EVENTS IN NUCLEAR EMULSIONS. Y. K. Lim (Univ. of Malaya, Singapore) and J. E. Laby and V. D. Hopper (Univ. of Melbourne). Nuovo cimento (10) 15, Suppl. No. 3, 382-6(1960). (In English)

The derivation of an equation for determining the efficiency of emulsion scanning is given. Results are tabulated for area scans of 3G1, 3G3, and 1G1 normal and loaded emulsions. Sources of error are discussed. (B.O.G.)

13891

ABSOLUTE MEASUREMENTS OF PHOTON BEAM FROM SYNCHROTONS BY IONIZATION CHAMBERS. I. N. Usov

(Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 17-19(1959) Nov.-Dec. (In Russian)

The long-range δ electrons carrying off part of the energy lost by secondary electrons in the operating chamber should be considered in measuring the photon beam intensity in high-energy ionization chambers. Formulas are derived for determining the photon beam. Considerations of long-range δ electrons in calculations of 260-Mev synchrotron bremsstrahlung altered the absolute sensitivity value of a thick-walled graphite chamber ($T = 4.5$ cm) by 2% and increased by 12% the absolute intensity magnitude measured with a thin-walled chamber by the couple difference method. (tr-auth)

13892

UNIVERSAL BETA SPECTROMETER WITH DOUBLE FOCUSING AT $\pi\sqrt{2}$ ANGLE. P. S. Samoilov. Pribory i Tekh. Ekspt. No. 6, 33-6(1959) Nov.-Dec. (In Russian)

Descriptions are given of a beta spectrometer with varying magnetic field topography accomplished without changing magnet poles, capable of double focusing (at $\pi\sqrt{2}$) a widely dispersed electron beam and with an empirically selected optimum field required by experimental conditions. The field configuration can be retained within the intensity range suitable for investigations of 2 kev to 6 Mev electrons. (tr-auth)

13893

CHARACTERISTICS OF THERMAL NEUTRON CORONA COUNTERS. A. I. Dokuchaev. Pribory i Tekh. Ekspt. No. 6, 41-5(1959) Nov.-Dec. (In Russian)

Characteristics of neutron counters with solid boron coatings (SNM-9) and based on corona discharge are investigated. The neutron pulse amplitudes approach 300 to 400 mv and depended only slightly on intensity. The resolving time did not exceed 1 to 2 μsec. The absolute counter efficiency for neutrons was $\sim 2 \times 10^{-3}$ at a discriminator threshold input of 50 mv. The counters were used in γ fields of 10^2 to 10^3 r/h and at temperatures up to 120 to 150°C. (tr-auth)

13894

DETECTION OF GAMMA-RADIATION IN SCINTILLATION PLASTOMERS. N. K. Pereyaslova (Inst. of Applied Geophysics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 45-7(1959) Nov.-Dec. (In Russian)

The application of a coincidence method for reducing the noise background and increasing the sensitivity of scintillation plastomers was investigated. (tr-auth)

13895

A DEVICE FOR MEASURING NUCLEAR MOMENTS BY THE METHOD OF MAGNETIC RESONANCE IN MOLECULAR BEAMS. A. G. Kucheryaev, Yu. K. Szhenov, Sh. M. Gogichaĭshvili, I. N. Leont'eva, and L. V. Vasil'ev. Pribory i Tekh. Ekspt. No. 6, 48-57(1959) Nov.-Dec. (In Russian)

Descriptions are given of a new device for measuring nuclear moments. A method is developed for calculating refocusing systems with a given sensitivity to re-orientation; shown to be a function of the width of collimator slit. A method for detecting atomic beams in alkali earth elements is also included. (tr-auth)

13896

HIGH-SENSITIVITY PARA-MAGNETIC RADIOSPECTROMETER OF 9000 MHz. Ya. L. Shamfarov (Inst. of Radiophysics and Electronics, Academy of Sciences Ukrainian SSR). Pribory i Tekh. Ekspt. No. 6, 57-61(1959) Nov.-Dec. (In Russian)

The design is given of a high-frequency, paramagnetic, superheterodyne, 9000 MHz spectrometer with a stabilized klystron frequency adapted to a measuring resonator and with an automatic frequency adapter for a local heterodyne. The design allows observations of pure paramagnetic absorption (eliminates dispersions) and supresses the noise related to the signal klystron and measuring resonator fluctuations. (tr-auth)

13897

TRIGGERED FEEDING OF GEIGER-MUELLER COUNTER PAIR. L. Mitrani and B. Betev (Inst. of Physics, Academy of Sciences, Bulgaria). Pribory i Tekh. Ekspt. No. 6, 64-6 (1959) Nov.-Dec. (In Russian)

A new method of coupling two Geiger-Mueller counters was devised, based on relaxation in two stabilization states (with symmetric Ikklaz-Jordan starting system). (R.V.J.)

13898

MULTICHANNEL AMPLITUDE ANALYZER WITH A MECHANICAL COMMUTATOR. N. L. Grigorov, V. Ya. Shestoperov, and V. A. Sobinyakov (Scientific-Research Inst. of Nuclear Physics, Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 67-9(1959) Nov.-Dec. (In Russian)

The block diagram and a short description are given of a device for simultaneously determining amplitudes in a large number of channels. A mechanical commutator is the basic element of the device. The resolving time of the scheme is 0.25 sec. The scheme consists of a small number of electron tubes and is very reliable. (tr-auth)

13899

BACKGROUND COMPENSATION IN SPECTROMETER HIGH-VOLTAGE RECTIFIER. L S. Gorn and B. I. Khazanov. Pribory i Tekh. Ekspt. No. 6, 88-9(1959) Nov.-Dec. (In Russian)

A scheme for attenuating the rectifier background and grounding the spectrometer (FEU) cathode is described. (R.V.J.)

13900

MEASURING DEVICE FOR SMALL AMPLITUDE VIBRATIONS. K. V. Chernyshev (Inst. of Physics, Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 98-9(1959) Nov.-Dec. (In Russian)

The design and calibration of a measuring device for small-amplitude vibrations are described. The sensitivity of the device is 0.5×10^{-8} to 10^{-8} cm. (tr-auth)

13901

PROBE FOR MEASURING WEAK CURRENTS IN A CYCLOTRON. E. S. Mironov, L. M. Nemenov, N. I. Sokolov, and N. N. Khaldin. Pribory i Tekh. Ekspt. No. 6, 116-7(1959) Nov.-Dec. (In Russian)

Descriptions are given of a screened probe for measuring weak current of charged particles accelerated in a cyclotron and the small-current multicharged ions in the strong-current background induced by ions accelerated by "subharmonics." (tr-auth)

13902

FAST-ACTING BUBBLE CHAMBER DOUBLE-ACTING GAS VALVE. L. M. Barkov, K. N. Mukhin, A. V. Tel'nov, and R. S. Shlyapnikov. Pribory i Tekh. Ekspt. No. 6, 122-4 (1959) Nov.-Dec. (In Russian)

A fast-acting double-action valve was designed for operation with a 10 l propane bubble chamber. The valve performs with 0.5 l gas exhaust under 50 atm. pressure at ~5 μsec and chamber volume refilling up to 50 atm. in ~30 μsec. (R.V.J.)

13903

VACUUM FURNACES. I. V. Salli (Dnepropetrovsk State Univ., USSR). Pribory i Tekh. Ekspt. No. 6, 128-9(1959) Nov.-Dec. (In Russian)

Two types of furnaces for heating specimens up to various temperatures (~1700°C) followed by tempering in mercury or vacuum oil are described. (R.V.J.)

13904

GAS AMPLIFICATION IN PROPORTIONAL COUNTERS. S. Ramakrishna (Indian Inst. of Science, Bangalore). Proc. Indian Acad. Sci., Sec. A 51, 117-22(1960) Feb. (In English)

The variation of gas amplification with applied voltage is an important characteristic of a proportional counter. Results of studies on gas amplification for gas fillings of argon quenched with ethane and carbon dioxide are given. The effects of pressure, quenching agent, and concentration on Ar are discussed briefly. (auth)

13905

ELECTRONIC MEASUREMENT OF PARTICLE SIZE. H. E. Kubitschek (Argonne National Lab., Lemont, Ill.). Research (London) 13, 128-35(1960) Apr.

A novel counter which detects and measures particles in suspension by means of their electrical resistance is described. This instrument can count red blood cells at rates exceeding 5000 particles per second, and with modifications is capable of determining the volumes of spheres as small as 0.2μ in diameter. The operation of the counter and its advantages over optical counters are discussed, along with its applications to biology, medicine, and industry. (auth)

13906

DESIGN OF A 100-KILOGAUSS 4-INCH CORE SOLENOID FOR CONTINUOUS OPERATION. W. F. Giauque and D. N. Lyon (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 374-90(1960) Apr.

The design of high field cylindrical solenoid magnets for continuous operation is discussed. Equations are given relating power input, allowable temperature rise, coolant rate, and pressure drop to give the detailed dimensions required for the electrical conductor and the cooling annuli. The stresses from electromagnetic forces acting upon conductors are discussed, equations are given, and some devices and factors concerned in resisting these forces are described. The properties of kerosene as a magnet coolant and safety precautions for its use are discussed. The details for a magnet with a 4-in. air core, constructed for good homogeneity, and 7.5 Mw of power are given. A procedure for preparing laminated insulation in the form of a spiral is described and a method of squaring the magnet ends to improve heat transfer, reduce heat production, and facilitate support at the ends has been devised. Equations are given which enable the evaluation of the conductor temperature at any point along the coil by making use of the temperature coefficient of resistance for thermometric purposes. Conductor and kerosene temperatures as a function of axial length are given for data obtained from magnet operation. The particular magnet described, which is the first of several to be built, gave a field of 99,500 gauss at 7.5 megawatts. Some suggested improvements based on experience with the present magnet have been included. (auth)

13907

LOW BACKGROUND THIN-WALL FLOW COUNTERS FOR MEASURING BETA ACTIVITY OF SOLIDS. Devendra Lal and David R. Schink (Scripps Institution of Oceanography, La Jolla, Calif.). Rev. Sci. Instr. 31, 395-8(1960) Apr.

The construction and performance of disk-shaped thin-walled flow counters suitable for measuring very small beta activities of solids is described. The circular faces, which serve as the cathode, consist of conducting films. Either a single pear-shaped loop of wire whose plane is parallel to that of the faces, or a group of straight wires stretched across the midplane serves as the anode. The counters are operated in the Geiger region. Samples can be counted against both faces of the counter. Performance data are given for counters having active volumes of 0.2 to 7 cc, and having active areas of 1.6 to 23 cm^2. Counting efficiencies for natural potassium (mounted on Lucite) vary from 30% to 47%, depending on the relationship of sample area to counter dimensions. Inside a 20-cm steel shield and an anticoincidence ring the background counting rates varied approximately as 1 count/hr/cm^2 of counting area. Backgrounds as low as 1 count/hr were obtained. The disk geometry permits the use of a smaller metal and anticoincidence shield than is possible with cylindrical geometry. Counters shielded successively with 1.9-cm mercury, 5-cm steel, and 5-cm lead, and operated with a flat multiple-anode anticoincidence counter (15 cm^2), actually gave lower background than with the 20-cm steel and anticoincidence ring assembly. An integral counter assembly, consisting of ~2-cm diam disk-shaped counter and a disk-shaped guard counter (~7-cm diam), was constructed and gave satisfactory results. (auth)

13908

TRANSIENT ANALYSIS OF THE WHITE CATHODE FOLLOWER. Melvin Brown (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 403-9(1960) Apr.

The White cathode follower is a two-tube series device that provides output impedances of the order of 5 ohms and transmits pulses of either polarity with minimal distortion. A d-c and transient analysis of the White cathode follower is made, and a typical circuit is analyzed. The effect on the transient response of varying the circuit parameters is discussed. The White cathode follower is compared to the well-known conventional cathode follower. The White cathode follower may have an advantage in gain-bandwidth over the conventional cathode follower by a factor of five. (auth)

13909

RAPID CYCLING BUBBLE CHAMBER. Carl Wayne Vernon (Univ. of Washington, Seattle). Rev. Sci. Instr. 31, 421-4(1960) Apr.

The operation of a 500-cc compressed nitrogen driven propane bubble chamber at cycling rates up to 15 cps is described. A vapor pressure of 310 psi is found as optimum with a 540-psi compression pressure and a 7% volume change. The chamber was expanded into a 170-psi exhaust chamber. Excessive boiling and sensitive time are related to the cycling rate and expansion time. (auth)

13910

PULSE SIZE FROM NEUTRONS OF 0.14 TO 2.3 MEV IN PLASTIC SCINTILLATOR. M. Gettner and W. Selove (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr. 31, 450-1(1960) Apr.

The light output of a sample of plastic scintillator for proton recoils from neutrons of energy 0.14 to 2.3 Mev was measured. Recoil protons of 1-Mev energy give about $\frac{1}{5}$ the light from 1-Mev electrons; protons of 0.2 Mev give about $\frac{1}{8}$ the light from 0.2-Mev electrons. (auth)

13911

METHOD FOR DEFINING POSITION OF MAGNETIC FIELD LINES. Alan W. DeSilva and John M. Wilcox (Univ. of California, Berkeley). Rev. Sci. Instr. 31, 455-6(1960) Apr.

The method described was developed during experiments on Alfvén wave propagation. It was necessary to be sure that the hydromagnetic waveguide was accurately aligned with a uniform axial field. Tests indicate that the method would be valuable for use with various complex magnetic-field geometries that have been proposed for controlled thermonuclear heating. (B.O.G.)

13912

GLASS COMBUSTION BOMB. Ralph L. Nuttall, Margaret A. Frisch, and Ward N. Hubbard (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 31, 461-2(1960) Apr.

A glass combustion bomb is described which has proved invaluable in working out suitable combustion conditions for inorganic materials. It is possible to observe relative combustion temperatures, rates of burning, melting of sample or combustion products, spattering, fuse wire temperature, etc., and to study the effects of these at different pressures and sample arrangements. It is imperative that suitable shielding be in place before the bomb is used. (B.O.G.)

13913

APPARATUS FOR ACCURATE MEASUREMENT OF THERMOELECTRIC POWER. R. L. Eisner (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 31, 462-4(1960) Apr.

An apparatus is described for the accurate measurement of the Seebeck coefficient for cylindrical samples. The apparatus yields values of the bulk longitudinal thermoelectric power accurate to about 3%, whereas the error can be as much as 50% when the measurements are made by the conventional method. (B.O.G.)

13914

METHOD OF TERMINATING THE ENERGY INPUT TO AN ELECTRICALLY EXPLODED WIRE. Robert J. Reithel and James H. Blackburn (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 31, 464(1960) Apr.

In the study of electrically exploded wires and associated phenomena, it is sometimes useful to stop the energy input at a predetermined time. A method is described for accomplishing this termination in the laboratory. Results of the use of the method are given in amperes and joules as functions of time in μsecs. The results indicate that after the shorting action begins, there is ~10% energy increase and that the energy ceases in ~0.03 μsec. (B.O.G.)

13915

IMPROVED DETERMINATION OF THE EFFECTIVE RESOLVING TIME OF GEIGER COUNTERS. Kenzo Tanaka (Kyoto Univ.) and Ken-ichi Katayama and Toshihiko Amano (Asahi Chemical Industry Co., Ltd., Takatsuki, Japan). Rev. Sci. Instr. 31, 467-8(1960) Apr.

A method is outlined for determining the effective resolving time of Geiger counters. An effective resolving time of 182 ± 8 μsec was found for an Amperex 153C Geiger counter operating at 1500 v. The merits of this system are that: (1) it is simple and needs no particular apparatus; (2) K_τ on the actually operating condition can be measured; (3) results are not influenced by harmonics of the characteristic wave length; (4) it is not necessary to predetermine the transmittance of the filter; (5) the applicable range of the correction equation can be seen from a plot of the reciprocal counting rates before and after insertion of the filter; and (6) the x-ray source does not require long-term stability. (B.O.G.)

13916

NEW RADIOMETRIC WELL-LOGGING EQUIPMENT USING NEUTRON, PROPORTIONAL AND SCINTILLATION COUNTERS. D. F. Bespalov. p.209-12 of "Razvedka i Razrabotka Poleznykh Iskopaemykh. Trudy Vsesoyuznoĭ Nauchno-Tekhnicheskoi Konferentsii po Primeneniyu Radioaktivnykh i Stabil'nykh Izotopov i Izluchenii v Narodnom Khoziaistve i Nauke, 2d, Moscow, 1957." Moscow, Izdatel'stvo Akademii Nauk SSR, 1958. (In Russian)

A neutron proportional counter is described, and data obtained from tests are graphed and tabulated. The problem of monitoring the temperature effect by using a new scintillation counter, LS-4, designed for this purpose, is described. The counter employs NaI as a scintillator, and a radioisotope which produces softer radiation than the scintillator and sends guide pulses. Preliminary laboratory tests were made to determine the variation of these pulses with temperature. (OID)

Materials Testing

13917 NP-8627

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

WEAR AND FRICTION TEST. N. B. Dewees. Oct. 13, 1959. 10p., 7 illus. Project No. 90792-08. (T-Spec.-641046).

Test rigs for measuring the wear and friction of materials in sliding contact in various water environments are described. The test rigs were made for attachment to the inside of the head of an autoclave. Drawings, specifications, and operation of a test rig are contained. (C.J.G.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

13918 HW-37711

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE DETECTION OF EARTHQUAKES BY WATER-LEVEL RECORDERS. M. W. McConiga. Nov. 1955. 13p. Contract W-31-109-Eng-52. OTS.

Sharp fluctuations of the water levels in the Hanford area wells detected by continuous water level recorders have been correlated with official records of earthquakes on this continent and as distant as India and Israel. Data also showed that earthquake intensities on the threshold of damage to structures may have occurred, and that tremors of local origin are possible. (J.R.D.)

13919 RME-2066

Grand Junction Operations Office. Production Evaluation Div. Salt Lake Branch, AEC.

PRELIMINARY REPORT ON THE GEOLOGY AND URANIUM DEPOSITS OF HAIWEE RIDGE, INYO COUNTY, CALIFORNIA. W. Robert Power. Mar. 1958. 39p. OTS.

The Coso formation of Plio-Pleistocene age, consisting of rhyolitic volcanics, fanglomerates, and lake beds, overlies granite unconformably. It records a period of repeated volcanism and faulting on Haiwee Ridge and almost continuous deposition in Owens Valley that began in late Pliocene or early Pleistocene time. It is overlain unconformably by andesites. Recent normal faults cut the andesites. Uranium minerals believed to be hydrothermal in origin are found along pre-Coso formation fault zones at the unconformity between the granite and Coso formation. Other uranium minerals are disseminated in the Coso formation. (auth)

13920 SCTM-253-56(51)

Sandia Corp., Albuquerque, N. Mex.

OZONOSPHERE WINDS AND TEMPERATURES FROM ACOUSTIC OBSERVATIONS OF 1955 ATOMIC TESTS. Jack W. Reed. Oct. 25, 1956. 12p. OTS.

Ozonosphere winds and temperature conditions were determined from acoustic observations of 1955 atomic tests. Data are presented for the February to March period, and the seasonal trends are shown. (C.J.G.)

13921 TEI-752

Geological Survey, Washington, D. C.
GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. Semiannual Progress Report [for] June 1 to November 30, 1959. Dec. 1959. 123p. OTS.

Systematic mapping and general geology studies were conducted on the Lisbon Valley Area (Colo.-Utah), Colorado Plateau, Ambrosia Lake Area (N. Mex.), Shirley Basin Area (Wyo.), Black Hills (S. Dak.), and in Duval County, Texas. The construction and performance of a beryllium detector, an automatic multi-timing device, a d-c magnet, an apparatus for radon condensation from atmospheric air, and an alpha scintillation flow counter are discussed. Systematic mapping, geology, and geochemistry of thorium and uranium deposits in the Powderhorn District (Colo.), Wet Mountains Area (Colo.), Hawaiian Islands, Virginia (Fairfax County), Medicine Lake Highland Area (Calif.), Lassen Volcanic National Park (Calif.), Big Bend National Park (Texas)., Bishop Area (Calif.), and igneous rocks of the Idaho Batholith are considered. The tritium and deuterium contents of atmospheric hydrogen samples collected near Buffalo, New York, Hamburg, Germany, and Nurenburg, Germany, during 1954 to 1956 were measured. The results of magnetic susceptibility studies on TiO_2 are reported. Geochronology studies by the Pb—U method are analyzed. Studies on the origins of ore deposits by lead isotope age estimations are discussed. (C.J.G.)

13922 UCRL-5757

California. Univ., Livermore. Lawrence Radiation Lab.
GEOLOGIC STUDIES OF UNDERGROUND NUCLEAR EXPLOSIONS RAINIER AND NEPTUNE. Final Report. Thomas L. Thompson and John B. Misz. Oct. 28, 1959. 59p. Contract W-7405-eng-48. OTS.

The approximate physical distribution and condition of displaced and ruptured rock materials in the Rainier and Neptune areas were established by geologic observation of structural and lithologic details, and stratigraphic correlations. The effects of the detonations were found to be related to the rock types considered from the standpoint of engineering materials as well as to their structural positioning. Gross displacements and fracturing are in apparent accord with Mohr theory of rupture stress orientation. Factual data find explanation on the fundamental basis of primary (blast) and secondary (gravity) induced principal stresses. The 90 ± 20-ton Neptune explosion disaggregated and displaced rock materials to a radial distance which ranged between 45 and 100 feet from ground zero depending on the orientation of bedding plane weaknesses and proximity of the ground surface to the point of detonation. Primary fracturing extended from ground zero to a radial distance which ranged from 55 feet to an estimated 145 feet depending on the favorable distribution of geologic structural weaknesses. Neptune was found to exhibit primary (blast) and secondary (gravity) rupture features which are fundamentally the same as those found in the Rainier area. The 1700-ton Rainier shot initially formed a fused-rock-lined cavity of an average 62 ± 10-foot radius below ground zero and an undetermined radius above ground zero. Gross primary rock displacement and gain disaggregation took place to a radial distance of from 80 to 130 feet from ground zero. Visible primary fracturing extended to a radial distance which ranges between 150 and 220 feet depending on the proximity of hard brittle rock (welded tuff) which, it is concluded, transmitted rupture stresses to a much greater distance than the "punky" granular tuff. Collapse of rock material into the initial cavity was favored by primary shear fractures, which developed prominently to a radius of 150 feet from ground zero. The collapsed rock defines a 100-foot-diameter cylindrical zone. This zone is presumed to extend for 388 feet upward from ground zero. A dome-shaped top is postulated on the basis of Mohr stress theory. It should be noted that, with the exception of drill hole G, there has been no drilling or underground working above the "Raise" Drift. Cavities, distributed around the perimeter of the cylinder, are attributed to variations in the coherence of the rock strata which were disrupted during collapse. The collapse block has remained essentially intact. This fact, coupled with the virtual absence of radioactive fission products above ground zero and nearly complete pulverization of the central collapse block, leads to the conclusion that underground nuclear explosions are applicable to mining by block-caving methods. Furthermore, material within the crushed zone should be mineable without the use of additional explosives. The mineability of material within the fracture limit is a question that is difficult to answer at present, as the degree of fracturing has not been established. Perhaps the direct approach of experimental excavation would be the best solution to the problem. The conclusions presented should be considered as hypotheses awaiting verification. There is still much to be learned from the Rainier explosion. (auth)

13923

CHRONOLOGY OF MAJOR METAMORPHIC EVENTS IN THE SOUTHEASTERN UNITED STATES. Leon E. Long, J. Laurence Kulp, and F. Donald Eckelmann (Columbia Univ., Palisades, N. Y.). Am. J. Sci. 257, 585-603(1959) Oct.

Potassium-argon and rubidium-strontium age measurements have been made on a variety of granites, pegmatites, gneisses and schists which comprise the plutonic-metamorphic complex of the Piedmont and Blue Ridge of the southeastern United States. Large portions of the area appear to have been metamorphosed initially approximately at the same time as the Grenville Province, i.e., about 900 to 1100 m.y. ago. Superimposed on this older metamorphic province was a major orogenic event culminating at about 350 m.y. with widespread recrystallization of existing rocks and intrusion of pegmatites in the Spruce Pine, Franklin-Sylva and Bryson City Districts, and granites in the Virginia and North Carolina Piedmont. There is strong evidence of an additional metamorphic epoch between 350 and 1000 m.y., but its effects have been largely obliterated by the 350 m.y. event. In western North Carolina a transition of apparent ages from 355 to 890 m.y. occurs in the same rock unit (Cranberry gneiss) over a distance of about 10 miles across the strike of the border of the 350 m.y. event. In the southeastern Piedmont of Georgia and South Carolina a younger metamorphic event or events can be detected producing rocks of apparent age ranging from 230 to 310 m.y. The time of these orogenies is compared with those in the Central and Northern Appalachians. Evidence is accumulating that the Holmes' time scale will have to be considerably lengthened. (auth)

13924

URANIUM AND THORIUM IN SELECTED SUITES OF IGNEOUS ROCKS. Esper S. Larsen, 3d and David Gottfried (U. S. Geological Survey, Washington, D. C.). Am. J. Sci. 258-A, 151-69(1960).

The uranium and thorium contents of 199 igneous rocks from a variety of petrographic provinces are here summarized. Data are given for the Mesozoic calc-alkalic batholiths of the western United States; volcanic and hypabyssal rocks of the tholeiitic magma type from Hawaii and Virginia; and effusive calc-alkalic, alkalic, and subsilic-alkalic rocks from the western United States and Hawaii. The batholithic rocks show an increase of both uranium and thorium from gabbro to quartz-monzonite and granite. The more extreme differentiates, chiefly muscovite-quartz monzonites, contain considerably less uranium and thorium than the quartz monzonites and granites, although the Th/U ratios are nearly the same. The volcanic and hypabyssal rocks in general show a similar increase in both thorium and uranium toward the more felsic members. The alkalic basalts of the Honolulu volcanic series show an anomalous decrease in uranium and thorium toward the right on a variation diagram. The Th/U ratios remain fairly constant from the mafic to the felsic members of each series studied: each series also has a more or less characteristic Th/U ratio, ranging from 2½ to 5. The scatter of thorium contents, uranium contents, and Th/U ratios is larger with increasing complexity of magmatic differentiation. The batholithic rocks have the greatest scatter, and have a significantly lower Th/U ratio in the gabbros than in the more felsic members. The data show no increasing loss of uranium relative to thorium from the magma during the later stages of crystallization. (auth)

13925

PROSPECTING CRITERIA FOR URANIUM DEPOSITS. M. M. Konstantinov. Atomnaya Energ. 8, 228-38(1960) Mar. (In Russian)

Criteria for evaluating the uranium of districts and individual deposits and ore bodies are analyzed. (tr-auth)

13926

DAKOTA GROUP OF COLORADO PLATEAU. Robert G. Young. Bull. Am. Assoc. Petrol. Geologists 44, 156-94 (1960) Feb.

Basal Cretaceous deposits of the Colorado Plateau can be subdivided into two formations on the basis of carbonaceous content. The lower non-carbonaceous unit, the Cedar Mountain formation, consists of mudstones and persistent conglomeratic sandstones which were deposited in an inland floodplain environment. The upper carbonaceous unit, the Naturita formation, consists of carbonaceous mudstone, coal, persistent conglomeratic sandstones, and beach sandstones deposited on or adjacent to the shore of the Mancos sea. Naturita deposits can be traced landward into Cedar Mountain deposits, indicating that they are facies of a larger unit, the Dakota group. Advancing Cretaceous seas reached the eastern edge of the Plateau in late Albian time but did not inundate the entire Plateau until late Greenhorn or early Carlile time. The westward advance of the sea was a halting one. Sharp pulses of basinal subsidence, accompanied by uplift in the source area west of the Plateau, resulted in rapid westward transgressions of the sea. Deposition, essentially confined to periods of quiet following the transgressions, caused some regression of the sea but transgressions exceeded the regressions and resulted in a slow westward advance of the sea. Many pulses of subsidence occurred but five major ones, which were accompanied by uplift in the source area, are reflected in the five widespread orogenic sandstones present in these deposits. (auth)

13927

THE POTASSIUM–ARGON AGE OF TEKTITES. W. Gentner and J. Zähringer (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 15a, 93-9(1960) Feb. (In German)

The K-Ar ages of Bediasites and Moldavites have been measured to be 29.4 and 8.7 × 10^6 years, while tektites from different localities between Indochina and Australia gave, within the experimental errors, concordant ages of 610,000 years. These results agree with the ages of the formations on which tektites have lain. The contribution of this work to theories about the origin of tektites is discussed. (auth)

13928

THE CRYSTAL STRUCTURE OF META-ZEUNERITE $Cu(UO_2)_2(AsO_4)_2 \cdot 8H_2O$. F. Hanic (Inst. of Inorganic Chemistry, Slovak Academy of Sciences, Bratislava). Czech. J. Phys. 10, 169-81(1960). (In English)

The structure of the mineral zeunerite (deposits at Rotava near Kraslice, Ore Mountains) was determined. The tetragonal unit cell, having the dimensions a = 7.10 A and c = 17.70 A, contains two structure units of $Cu(UO_2)_2(AsO_4)_2 \cdot 8H_2O$. The space group is $P4_2/nmc$. The distribution of the atoms in the unit cell was determined from the Patterson projection P(vw) and by means of $(F_0 - F_c)$ synthesis. Meta-Zeunerite has a layer type structure. The sheets $[(UO_2)(AsO_4)]_\infty$ are separated by layers containing the cations $(Cu(H_2O)_4)^{2+}$ and molecules of water. The uranium is coordinated octahedrally with six oxygen atoms at distances: $U-O_1$ 1.94A, $U-O_2$ 1.78A, $U-O_{3(4)}$ 2.18A (4×). The uranyl radical O_1-U-O_2 is linear. In the tetrahedron AsO_4 the interatomic distances are As–O 1.77A and the bond angles 102, 102, 113 and 113°. Each oxygen atom of the tetrahedron AsO_4 is simultaneously bonded to the uranium atom. The bond angle As–O–U is 137°. The layers $[(UO_2)_2(AsO_4)]_\infty$ are bonded together by the cations $(Cu(H_2O)_4)^{2+}$ The distances $Cu-O_1$ and $Cu-O_2$ are 2.55 and 2.58A respectively. The structural changes during hydration and dehydration are explained. (auth)

13929

DATING GALENAS BY MEANS OF THEIR ISOTOPIC CONSTITUTIONS. PART II. R. D. Russell and R. M. Farquhar (Univ. of British Columbia, Vancouver and Univ. of Toronto). Geochim. et Cosmochim. Acta 19, 41-52(1960) Mar. (In English)

A rather large number of analyses of common lead samples now available has led to a better understanding of the precise nature of the physical and geological processes resulting in the observed variations of lead isotope ratios. Specifically, there now appear to be three classes of leads, each of which has lead isotope ratios that vary in a remarkably simple pattern. These are meteoritic leads, anomalous leads, and leads from certain conformable lead ore deposits. The meteoritic leads and conformable leads both appear to have developed in surroundings where thorium and uranium had very similar properties, and in both cases the thorium to uranium ratio corresponds to a present value of 3.73 ± 0.03. This is taken to be evidence that both classes developed under predominantly reducing conditions. In contrast, the presence of thorium to uranium ratio present during the production of anomalous leads is extremely variable, suggesting an oxidizing environment. It has been suggested that all vein leads may be anomalous to some degree and therefore should be interpreted with this possibility in mind. The methods for dating galenas proposed previously by the present writers are reexamined in view of these developments and it is shown that they may lead to more explicit information on the age and history of lead ores than has usually been obtained. (auth)

13930

THE RECORD IN THE METEORITES. II. ON THE PRESENCE OF ALUMINIUM-26 IN METEORITES AND TEKTITES. E. Anders (Univ. of Chicago). Geochim. et Cosmochim. Acta 19, 53-62(1960) Mar. (In English)

A search for cosmic-ray produced Al^{26} was undertaken in meteorites and tektites, using $\gamma-\gamma$ coincidence spectrometry. The sensitivity and specificity of this method were sufficient to permit non-destructive measurement of Al^{26} in a 70 g specimen of the Plainview chondrite; the specific activity found, 0.058 ± 0.005 positrons min^{-1} g^{-1}, agrees well with the value of Ehmann and Kohman. In the case of tektites, chemical separation of the aluminum fraction was required because of interference by the U and Th series. Although a very small amount of activity was found in the aluminum fraction from an australite, corresponding to an apparent Al^{26} content of 0.005 ± 0.009 positrons min^{-1} g^{-1}, and a "flight time" of $1.1 \pm 2.0 \times 10^5$ years, it is shown that even this low counting rate was due to some contaminant, rather than Al^{26}. Corrected for this contaminant, the counting rate becomes 0.000 ± 0.009 positrons min^{-1} g^{-1}, and the upper limit for the Al^{26} content of australites, ≤ 0.022 disintegrations min^{-1} g^{-1} in contrast to the Ehmann and Kohman value of 0.040 ± 0.011. This limit corresponds to a "flight time" of $\leq 5 \times 10^5$ years. In view of this result, a terrestrial origin of tektites has once more become a possibility. (auth)

13931

ARGON DETERMINATION IN POTASSIUM MINERALS. VII. DIFFUSION ESCAPE OF ARGON IN MINERALS AND ITS EFFECT ON THE POTASSIUM–ARGON AGE DETERMINATION. H. Fechtig, W. Gentner, and J. Zähringer (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Geochim. et Cosmochim. Acta 19, 70-9(1960) Mar. (In German)

In calcium-containing minerals Ar^{37} was produced with the aid of a (n, α) reaction and the diffusion of Ar^{37} was measured as a function of temperature. Owing to the high sensitivity of this method it was possible to measure diffusion constants down to room temperature. For fluorite, anorthite, augite, and margarite the diffusion constants determined at room temperature are 10^{-21} to 10^{-25} cm^2/sec. These results are in agreement with those obtained by the potassium–argon age determination. The shape of the curves D(1/T) shows two knees which account for the discrepancy of the values obtained by other methods through extrapolation. (auth)

13932

GAMMA PROSPECTING. A. N. Timofeev (Inst. of Geophysics, Urals Branch of the Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 12, 1873-5 (1959) Dec.

Qualitative evaluations are made of γ radiation intensity variations, using radio emanation and diffusion in radioactive deposits covered by inactive overburden. It is shown that the maximum depth of gamma prospecting for radioactive deposits with inactive overburden can be increased by means of radiation emitted by diffusing radon decay products. (R.V.J.)

13933

URANINITE AND THORIANITE. Bibhuti Mukherjee (Geological Survey of India, Calcutta). Nature 186, 464-5(1960) May 7.

A study was made of the effect of heat treatment on reduction of cell size of gamma uraninite to correspond to age values consistent with those of the alpha type. A number of specimens of uraninite from Bisundni and Gaya and thorianite from Ceylon was used for the study. Data are tabulated on the shrinkage of the cell size of uranium dioxide as followed by a close doubling of the higher-angle diffraction lines. The oxidation of uraninite out of contact with oxygen suggests that in the oxygen-rich lattice of natural uraninite the excess of oxygen occupies the available interstitial positions in six-fold coördination with uranium and the shrinkage of cell size implies simultaneous replacement of U^{4+} cations by the U^{6+} cations, that is, the substitution of cations of smaller ionic radii and higher charge is preceded by readjustment of interstitial anions in the fluorite-type lattice. The progressive reduction of cell size of uranium dioxide due to the substitution of Pb^{4+} for U^{4+} within the lattice with time is considered to be negligible. (C.H.)

13934

POTASSIUM–ARGON AGES IN THE PRECAMBRIAN BASEMENT OF COLORADO. C. E. Giffin and J. L. Kulp (Columbia Univ., Palisades, N. Y.). Bull. Geol. Soc. Am. 71, 219-22(1960) Feb.

A survey was made of the Precambrian rocks of Colorado with two major objectives in mind: to search for possible occurrences of the 2600 m.y. old basement and to delimit the areas affected by the 1400 and 1000 m.y. events. The Ar^{40}/K^{40} method was used because it is believed to be accurate to at least ±4%. The decay constants for K^{40} used in calculating the results are $\lambda_\beta = 4.72 \times 10^{-10}$ yr^{-1} and $\lambda_e = 0.584 \times 10^{-10}$ yr^{-1}. (W.L.H.)

13935

ON THE POSSIBLE MAGNETIC EFFECT IN NUCLEAR AIR EXPLOSIONS. O. I. Leipunskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 38, 302-4(1960) Jan. (In Russian)

Atomic explosions at an elevation where the products of the blast disperse in a partial vacuum (Argus explosion at 500 km) are analyzed. (R.V.J.)

13936

Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

PECHBLENDAS CON ALTO CONTENIDO DE CIRCONIO DE GUANDACOL, LA RIOJA (ARGENTINA). Informe No. 21. (Pitchblende with High Concentration of Zirconia of Guandacol, La Rioja (Argentina)). Report No. 21. C. E. Gordillo, E. Linares, and R. J. Poljak. 1959. 11p.

Two high zirconium pitchblendes from La Rioja (Argentina) are studied. The pitchblende occurs in small very pure lenses and thin layers in sedimentary carboniferous strata and is characterized by an anomalous high content of Zr up to 5% ZrO$_2$. The associated sandstone contain only trace amounts of Zr. It is assumed that this uraniferous area is well characterized by this element. The microscopical study, complete chemical analysis, and the x-ray diffraction investigation of the best preserved sample is given. The density and structure is discussed on a "defect lattice hypothesis" of uranium cations. (auth)

13937

Geological Survey, Washington, D. C.

SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF URANIUM-BEARING VEINS IN THE UNITED STATES. Basil G. Dean. Geological Survey Bulletin 1059-G. 1960. 109p. $0.75(GPO).

This bibliography of 211 annotated references lists reports available as of June 1957. The annotations, arranged alphabetically by author, emphasize the geologic aspects of veins that contain uranium. An index map shows the location of vein deposits referred to in the annotations. Indexes are provided with entries listed according to author, geographic area, and subject. (auth)

13938

Geological Survey, Washington, D. C.
GEOLOGY AND URANIUM OCCURRENCES IN THE MILLER HILL AREA, CARBON COUNTY, WYOMING. James D. Vine and George E. Prichard. Geological Survey Bulletin 1074-F. 42p., 3 illus. GPO.

Uranium occurs in the North Park(?) formation of Pliocene(?) age in the Miller Hill area, about 25 miles south of Rawlins, Carbon County, Wyo. The North Park(?) formation in the Miller Hill area is at least 800 ft thick and unconformably overlies all older rocks. It consists principally of waterworked fine-grained pyroclastic debris and detrital mineral grains and includes several fresh-water limestone beds. Beds of brecciated silicified limestone 3 to 10 ft thick contain the principal concentrations of uranium. Lesser concentrations are found in calcareous sandstone and quartzite. Uranophane, $Ca(UO_2)_2Si_2O_7 \cdot 6H_2O$, the principal uranium mineral, has been deposited in vugs as fracture and surface coatings, and as a disseminated constituent of the rock. Uranium also occurs in quantities too small to be megascopically visible in dark-colored beds of chalcedony, limestone, and quartzite. The uranium deposits in the Miller Hill area are thought to be a secondary concentration deposited from ground-water solutions that leached disseminated uranium from thick porous beds of tuffaceous sandstone in the North Park(?) formation. It is suggested that the mechanism for deposition was the reaction of silica- and uranium-rich ground water upon contact with limestone. The higher grade concentrations may represent further recent surficial enrichment of uranium due to evaporation of capillary moisture; however, uraniferous limestone that is continuously exposed to weathering for a relatively long period of time is eventually leached. As much as 0.5% uranium is contained in grab samples, but only about 1,000 tons of rock is known to contain as much as 0.03% uranium. Visual spectrographic analyses of 31 samples of mineralized limestone are tabulated. (auth)

13939

Geological Survey, Washington, D. C.
GEOLOGY AND URANIUM DEPOSITS OF MONUMENT VALLEY, SAN JUAN COUNTY, UTAH. Richard Q. Lewis, Sr. and Donald E. Trimble. Geological Survey Bulletin 1087-D. 30p., 2 illus. $1.00(GPO).

Exposed consolidated sedimentary rocks in the Monument Valley area, Utah, range from Permian to Jurassic in age and attain an aggregate thickness of more than 3,000 feet. As all the uranium-vanadium deposits in the area are restricted to the Shinarump member of the Chinle formation of Late Triassic age, this study was principally concerned with that unit. The contact between the Shinarump member of the Chinle formation and the underlying Moenkopi formation is marked by a number of deep scour channels cut into the Moenkopi and filled with sandstone and conglomerate of the Shinarump. All the uranium-vanadium ore deposits are restricted to the lower channel sediments of the Shinarump. All channels are considered worthwhile areas for prospecting. The ore deposits are small tabular to lenticular bodies that range from a few inches to 10 feet in thickness and are commonly less than 20 feet in width. The ore minerals replace the cementing material in the sandstone and coat fractures, joints, and bedding planes. The common uranium ore mineral is tyuyamunite. Uranophane, autunite, and uraninite are also present in important quantities. The common vanadium mineral is corvusite; navajoite and hewettite are found in lesser amounts. The deposits are zoned both laterally and vertically, with the higher grade vanadium ore generally below and downdip from the uranium. In general the deposits are oxidized or partly oxidized. Most of the ore is the yellow hydrous uranium vanadate; however, quantities of black unoxidized ore containing uraninite and vanadium minerals with an intermediate valence are found in the deeper parts of some deposits. Good guides to ore within channel sediments are high radioactivity, uranium, vanadium, and copper minerals, and fluorescent silica, commonly hyalite. (auth)

13940

Geological Survey, Washington, D. C.
STRATIGRAPHY OF MIDDLE TERTIARY ROCKS IN PART OF WEST-CENTRAL FLORIDA. Wilfred J. Carr and Douglas C. Alverson. Geological Survey Bulletin 1092. 114p., 3 illus. $1.25(GPO).

The results of part of a geologic study of the phosphate deposits in central Florida are presented. The area in Hellsborough and Polk Counties called the Land-Pebble Phosphate District produces ~$^3/_4$ of the phosphate mined in the U. S. The ultimate objective of the work in Florida is to determine the geologic history of the phosphate deposits and associated sediments in order that the distribution of phosphate and uranium will be more clearly understood. (W.L.H.)

13941

ABSOLUTE AGE DETERMINATION OF SEDIMENTARY ROCKS. J. Laurence Kulp (Columbia Univ., Palisades, N. Y.). 11p. of "Fifth World Petroleum Congress, 1959."

The present status of the uranium—lead, potassium—argon, and rubidium—strontium methods of absolute age determination is reviewed. It is concluded that any of these methods can give dates that are accurate to at least 5% under suitable conditions. Relative ages to 1% are possible. The uranium—lead method is limited by the rare occurrence of sedimentary phases with a sufficiently high uranium to common lead ratio. It provides an important independent control in some cases. It may also be used to determine the age of rocks contributing the sedimentary material. The rubidium—strontium method appears most applicable to glauconite. It is limited in post-Cambrian times to phases with a high rubidium to common strontium ratio. The most useful age method for sedimentary rock would appear to be that based on the decay of K^{40}. Age measurements may be possible not only on glauconite but many types of shales that contain largely authigenic potassium minerals. Basaltic intrusions intercalated in the sedimentary column also appear promising. This method is sufficiently sensitive so that, in principle, ages may be determined down into the range of the carbon-14 method, i.e., 50,000 years ago. The available quantitative age measurements on sedimentary rocks are presented and with certain other data used to infer a new geological time scale. It now appears that the so-called Holmes scale which has been widely used in the last two decades is quite incorrect. Beginning with the Paleozoic the scale must be stretched by at least 100 m.y. The uppermost Cambrian must be at least 520 m.y., and the Carboniferous-Devonian boundary at least 320 m.y. An attempt is made to indicate the likely developments of these methods and the types of problems in petroleum geology to which they may be most applicable. (auth)

HEALTH AND SAFETY

13942 A/AC.82/G/L.304

Sweden. Försvarets Forskningsanstalt, Stockholm.
RECENT FALLOUT MEASUREMENTS IN SWEDEN. Gunnar Lindblom. Oct. 1959. 9p.

Data are presented from measurements of fall-out at ground level in Sweden between January and September 1959. (C.H.)

13943 AFSWC-TN-59-18
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
SCATTERED GAMMA RADIATION MEASUREMENTS FROM A LANTHANUM-140 CONTAMINATED FIELD. Clayton L. Schlemm and Alexander A. Anthony, Jr. June 1959. 64p. Project No. 7806.

A 90° sector of a circle of approximately 500-foot radius was contaminated with a La^{140} aqueous solution to an approximate level of 0.65 millicuries per square foot as a means of simulating an area approaching an infinite contaminated field. Radiation measurements were made in an open hole with a PDR-27A radiac instrument to determine the percentage of the total radiation which was due to scattered radiation (skyshine). This was found to be approximately 11.5%. These measurements were made at selected points from approximately 42 inches above to 24 inches below ground level. Data were obtained in a miniature basement to determine the attenuation of the skyshine by various thicknesses of concrete on the roof. (auth)

13944 AFSWC-TN-59-36
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
SULFUR AS A SENSITIVE TOTAL NEUTRON DOSIMETER. John A. Blaylock, Eugene Omoda, and Ellen M. Hippeli. Jan. 1960. 30p. Project No. 7806.

A method is suggested for using sulfur as a total neutron dosimeter in connection with nuclear detonations. The technique was studied using the Los Alamos Godiva II assembly as a neutron source. Reliable measurements were obtained out to 367 yards from this relatively weak neutron source. After the technique was developed and the appropriate calibrations established, sulfur was used as a neutron dosimeter in Operation HARDTACK II. Comparison of the results of the sulfur technique with those of the more elaborate foil techniques shows very good agreement. This comparison also points out that the sulfur method makes it possible to monitor dosage to about three times the slant range presently covered by the foil method. (auth)

13945 DASA-529
Defense Atomic Support Agency, Washington, D. C.
PROGRESS REPORT ON THE HIGH ALTITUDE SAMPLING PROGRAM. Albert K. Stebbins, III. July 1, 1959. 40p.

The High Altitude Sampling Program was initiated in 1954 to determine the spread of weapon produced fission products through the stratosphere. U-2 aircraft operated by the Strategic Air Command have been sampling stratospheric air at various altitudes along North-South paths from 66° North to 57° South at 70° West since 1957. Isotopes Incorporated, the principle contractor in this program, has analyzed over 1500 samples to date. Further metrological correlation has evolved a model of the stratosphere which accounts for the non-uniform deposition of fission products. The total stratospheric inventory of Sr^{90} as of the Fall of 1958 was found to be 1 megacurie. The half-residence time of polar injections and equatorial injections into the stratosphere was found to be six months and twelve months, respectively. The major portion of the stratospheric debris moves into the troposphere through the midlatitude tropopause break. Predictions of Sr^{90} levels to be found in equilibrium bone have been made through 1972. (auth)

13946 FFIK-IR-K-228
Norway. Forsvarets Forskningsinstitutt, Lillestrõm.
RADIOACTIVE FALLOUT IN NORWAY. Studies of the Sr-90 and Cs-137 Pattern in Selected Precipitation Areas. H. Bergh, G. Finstad, L. Lund, O. Michelsen, B. Ottar, and T. Wik. Jan. 1960. 24p.

Data are presented on radioactive fall-out in Norway during 1959. Results are compared with those obtained in 1957 and 1958. Measurements were made of the total amounts of Sr^{90} and Cs^{137} brought down in precipitation during the year. Results are included from measurements of Sr^{90} and Cs^{137} in three well defined precipitation areas. (C.H.)

13947 IDO-12012
Idaho Operations Office. Health and Safety Div., AEC.
ANNUAL REPORT OF THE HEALTH AND SAFETY DIVISION, 1958. John R. Horan, ed. 165p. OTS.

The Health and Safety Division is responsible for the protection of property and the health and safety of people, plants, and animals at the National Reactor Testing Station and its environs. Noteworthy achievements during the period include the acquisition of a 256-channel analyzer which revolutionized the quantity and quality of the field monitoring programs; the initiation of a 13-week field training program for the Radiological Physics Fellowship Program; the development of the carbon cartridge for iodine and a new beryllium procedure; aerial monitoring by light aircraft with scintillation equipment proved a practical method for rapid survey of large ground areas and for cloud evaluation; and the construction and operation of a new fire station which added significantly to the fire protection program. Data are tabulated from routine monitoring activities. (C.H.)

13948 ITR-1320(Del.)
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
EARLY CLOUD PENETRATIONS. Preliminary Report. Ernest A. Pinson, Kermit C. Kaericher, James E. Banks, and John d'H. Hord. Sept. 1956. Decl. with deletions Apr. 8, 1960. 29p. Project 2.66 [of] OPERATION REDWING. OTS.

Measurements were made of the radiation dose and dose rate one would experience in flying through the cloud resulting from a megaton-range weapon. Twenty-seven penetrations were made of six radiation clouds at times ranging from 20 to 78 minutes after detonation and at altitudes ranging from 20,000 to 50,000 feet. Maximum radiation doses as high as 800 r/hr were encountered. Data are presented from measurements of radiation dose rates inside the cloud, the total dose received in flying through such a cloud, the total dose received on the return flight after flying through the cloud, and the conditions of flight inside the cloud. (C.H.)

13949 LAMS-2397
Los Alamos Scientific Lab., N. Mex.
RADIOACTIVITY IN ENVIRONMENTAL AIR AT LOS ALAMOS, NEW MEXICO FOR THE PERIOD NOVEMBER 17, 1958 THROUGH DECEMBER 31, 1959. William R. Kennedy, Jack W. Aeby, and Pablo O. Romero. Jan. 26, 1960. 22p. Contract W-7405-eng-36. OTS.

Data are tabulated from measurements of air particulate radioactivity at Los Alamos from Nov. 1958 through Dec. 31, 1959. Gamma background surveys were made daily and the beta activity was measured in samples of air and rain water. (C.H.)

13950 NP-8569
Sweden. Försvarets Forskningsanstalt, Stockholm.
THE CONCENTRATION OF SOME FISSION PRODUCT NUCLIDES IN GROUND-LEVEL AIR DURING THE PERIOD SEPTEMBER 1957—DECEMBER 1959. K. Edvarson and K. Löw. Mar. 1960. 17p.

The content of the nuclear weapon produced fission products Zr^{95}, Sb^{125}, Cs^{137}, and Ce^{144} in ground level air has been determined by γ-spectrometry for the period September 1957 to December 1959. By analysis of the relative amounts of these nuclides it has been possible to partly determine the origin of the different components in the debris. One result of the calculations is that about 50% of the Cs^{137} in the peak in the late spring of 1959 was due to debris of an older origin than the tests in the autumn of 1958. This is in support of the theory of seasonal variations in the transport properties of the upper atmosphere. (auth)

13951 NP-8656
Massachusetts Inst. of Tech., Cambridge.
APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 8 Covering Period December 1, 1960 through February 29, 1960. Pauline M. Austin. Mar. 15, 1960. 12p. DA Project No. 3-99-07-102. Contract DA-36-039-SC-75030.

Much of the emphasis in instrumentation has been directed toward the problem of accuracy of radar calibrations and the reliability of standard targets for calibration purposes. Both mylar radar mesh balloon covers and small aluminum spheres, six inches in diameter, have been tested and deemed unsatisfactory because the signal fluctuates widely. The peak values from these targets average 1 db high for the SCR-615-B and about 3 db low for the AN/CPS-9 when compared with values computed from the radar equation and the parameters obtained in direct beam pattern measurements. On precipitation measurements, however, when both the radars are sampling from the same region of the atmosphere, the AN/CPS-9 consistently measures 3 to 4 db high relative to the SCR-615-B. It has been established that this latter discrepancy is not due to non-Rayleigh scattering, and a satisfactory explanation has not yet been found. Some very good observations of winter precipitation were obtained during January, but a major breakdown of the azimuth rotation gears of the AN/CPS-9 prevented the taking of any significant data during February. Programming and testing of the IBM-704 computer program for the investigation of the modification of close-in fall-out patterns by precipitation is progressing well. It is estimated that it will be several months before results are available. (auth)

13952 NP-8676
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MEASUREMENTS OF RADIOACTIVITY IN WARSAW, POLAND, DURING THE YEAR 1959. Report No. 140/doz. R. Szepke, Z. Gorberg, and T. Deszczak. Mar. 1960. 30p.

Data are tabulated on the radioactivity in air, rain water, ground water, tap water, river water, and waste solutions from the Institute of Nuclear Research at Warsaw, Poland. The Sr^{90} levels due to fall-out were also measured in air and milk samples. (C.H.)

13953 TID-3087
Technical Information Service Extension, AEC.
RADIOACTIVE FALLOUT. A BIBLIOGRAPHY OF SELECTED UNITED STATES ATOMIC ENERGY COMMISSION REPORTS. Hugh E. Voress, Richard J. Smith, and James M. Jacobs, comps. Aug. 1959. 80p. OTS.

A total of 365 annotated references to unclassified AEC reports is presented on the physics and chemistry of fallout, its effects upon human life, and all other major aspects of the subject. Author, subject, and report number indexes are provided. (auth)

13954 TID-3552
Technical Information Service Extension, AEC.
SHIPPING AND STORAGE OF RADIOACTIVE MATERIALS. A Literature Search. Theodore F. Davis, comp. Apr. 1960. 22p. OTS.

A list consisting of 145 references to unclassified report literature and engineering drawings is presented as a guide to reports on shipping of radioactive materials. References on storage and handling are also included along with others on criticality and shielding. (J.R.D.)

13955 USNRDL-TR-410
Naval Radiological Defense Lab., San Francisco.
THE NRDL DYNAMIC MODEL FOR FALLOUT FROM LAND-SURFACE NUCLEAR BURSTS. A. D. Anderson. Apr. 5, 1960. 56p.

A fall-out computation method should be based on all the dynamics of the fall-out process, but current computation models do not provide more than generalized answers because they do not account for early time dynamics. In the attempt to account for the entire process, a theory for close-in fall-out was originated. This theory was checked by developing from it a mathematical fall-out model for land-surface bursts and then using this model to compute fall-out dose-rate patterns for two low-yield nuclear tests in Nevada. From a comparison of these patterns with the measured test patterns, it is concluded that the theory, as embodied in the D model, is sound, at least for low-yield land-surface bursts. Also, preliminary results indicate that the theory can be used to give accurate computations for bursts in the moderate and high-yield ranges. (auth)

13956 WT-1477
Federal Civil Defense Administration, Battle Creek, Mich.
PENETRATION INTO CONCRETE OF GAMMA RADIATION FROM FALLOUT. W. F. Titus. Apr. 27, 1960. 26p. Project 35.1 [of] OPERATION PLUMBBOB. OTS.

The penetration into concrete of gamma radiation from fall-out has been measured in an idealized geometry as a function of time after the detonation of a nuclear device. At the same time, the exposure dose rate in air at heights of 3 and 9 ft above the ground was measured with two detectors suspended from a tower and shielded from above with lead so as to be sensitive primarily to radiation from fall-out on the ground. For this test a sandwich made of seven concrete slabs, forming a mass of concrete with face dimensions large enough to reduce edge effects to a negligible amount, was buried with its top surface flush with the ground. Remote-reading detectors were placed between the concrete slabs, thus permitting measurements of dose rate as a function of depth in concrete. The concrete mass and the tower were located in the center of a cleared and leveled area approximately 200 yd in diameter. Thus the gamma radiation at the detectors originated from an essentially infinite-plane source of radiation. Results are presented both as a function of time after detonation and of depth of penetration of the radiation into concrete. A comparison of the results with theoretical calculations is made. (auth)

13957 NP-tr-358
ATOMIC WEAPONS AND PROTECTION AGAINST ATOMIC ATTACK. Translation of "Atomnoye Oruzhiye Protivoatomnaya Zashchita," Moscow, 1958. 160p. OTS.

Basic information is presented relating to the combat characteristics of atomic weapons and to the protection of troops against atomic attack. The principles of construction of atomic and hydrogen bombs and other radiological warfare agents are described. The characteristic effects of shock waves, thermal radiation, and ionizing radiation and their combat potentials are described. The contamination of the terrain by radioactive substances is discussed. Ways and means of protecting troops against the action of atomic weapons are considered. (C.H.)

13958 NP-tr-430

CHEMICAL SUPERVISION OF THE DISSEMINATION OF RADIOACTIVE SUBSTANCES. G. Herrmann. Translated by R. Presser (U.K.A.E.A. Atomic Energy Research Establishment) from Angew. Chem. 71, 561-71(1959). 49p. (Handwritten MS. copy).

The hazards and methods of analysis of radioisotopes are discussed. Methods of determination for Sr^{89}, Sr^{90}, Cs^{137}, Cs^{138}, I^{131}, Pu^{239}, and Ra^{226} are reviewed. The mechanisms of fall-out from nuclear weapons are discussed. (C.J.G.)

13959

DOSIMETRY OF INTERMEDIATE-ENERGY NEUTRONS. A. G. Istomina and I. B. Keirim-Markus. Atomnaya Energ. 8, 239-47(1960) Mar. (In Russian)

The maximum and mean neutron absorption by human tissue was calculated for the energy range from thermal to 1 Mev. The results were averaged for the typical 1/E spectrum under various conditions. The permissible maximum for intermediate energy neutrons is 680 n/cm^2 sec. Various methods for recording intermediate energy neutrons are analyzed, and descriptions are given of the thermal neutron detectors used. (tr-auth)

13960

MEASUREMENT OF RADIATION EXPOSURE AT THE WALLS OF MEDICAL X-RAY ROOMS FOR DETERMINING PROTECTIVE BARRIER REQUIREMENTS. S. W. Smith and Joe R. Brooks (National Bureau of Standards, Washington, D. C.). Atompraxis 6, 77-82(1960). (In English)

The computation of barrier requirements for x-ray rooms in medical radiological departments is ordinarily made by assuming near-maximum values for the various factors affecting the exposure of the barriers. This procedure, followed because of the lack of exact knowledge concerning these factors, may result in much heavier barriers than are actually required to reach the intended exposure level. This may include overestimation of the workload, the amount and quality of the stray radiation reaching the barrier, the fraction of the workload during which the useful beam is directed toward the barrier, the effect of coning, attenuation of the patient, and other factors difficult to evaluate. In order to obtain the necessary information under actual conditions of operation, about 70 pocket-type 200-mr ionization chambers were placed on the ceiling and walls of 26 diagnostic and 8 therapy x-ray rooms for periods of one or two months, to measure the radiation reaching these barriers under normal operating conditions. Additional chambers were placed in lead and aluminum shells of various thickness from which attenuation data could be obtained. The workload in terms of milliampere-minutes was in most cases recorded automatically. The data obtained indicate that the usual method of computing barriers may result in barriers several half-value layers thicker than actually required to reach the intended exposure level. (auth)

13961

RADIATION PROTECTION AND RADIATION BURDEN IN WORK WITH A 2000 CURIE Co^{60} IRRADIATION FACILITY R. Birkner and F. Kossel (Städtische Krankenhaus Moabit, Berlin). Atompraxis 6, 91-7(1960). (In German)

The use of γ radiators with activities up to several thousand curies does not involve greater danger if adequate protection is provided. A device used for medical purposes is described. Radiation-protection measurements made on the radiator head, in the vicinity of the device and in practical operation are reported. (auth)

13962

THE USE OF TELEVISION IN SUPER-VOLT THERAPY. F. K. Baum and H. Kuttig (Universität, Heidelberg, Ger.). Atompraxis 6, 97-9(1960). (In German)

A television set is described which has been used for 1½ years to observe patients receiving radiation from the telecobalt unit "Gammatron 1." The use of television has proven especially advantageous in comparison with previous methods because of the radiation protection it affords and because of its adjustability for each individual case. (auth)

13963

RADIATION PROTECTION IN HANDLING UNSEALED RADIOACTIVE MATERIALS. [PART] I. H. Gotte (Farbwerke Hoechst AG, Frankfurt am Main). Atompraxis 6, 99-107 (1960). (In German)

The conception of a radioactive contamination is explained and the hazards are estimated which may result from the uncontrolled spreading of radioactive material. Moreover, measures are described to prevent uncontrolled contamination and indications are made on how to handle radioactive materials in chemical laboratories. (auth)

13964

HANDLING GASEOUS FLUORINE AND CHLORINE TRIFLUORIDE IN THE LABORATORY. Joseph Gordon and F. L. Holloway (General Chemical Div., Allied Chemical Corp., New York). Ind. Eng. Chem. 52, No. 5, 63A-64A; 66A; 69A(1960) May.

Equipment and procedures for handling gaseous F_2 and ClF_3 in laboratories are described. The handling system can be placed in a walk-in hood; the gas cylinder is enclosed in a steel box and controlled by valve extensions. All the valving on the high pressure side is housed within this box. The system is cleaned of all grease and oils and dried; then it is checked for leaks. Nitrogen is attached to the system for dilution of the gas when needed. Metals can be used for the construction of the system since the gas forms a passive fluoride film which then resists further attack. Both gases are passed through a NaF scrubber prior to flow metering. Procedures for gas transfer to an empty cylinder and safety precautions are given. (D.L.C.)

13965

UNIT FOR MEASURING NEUTRON DOSAGE. M. F. Yudin. Izmeritel'naya Tekh. No. 1, 51-3(1960) Jan. (In Russian)

A unit for measuring neutron dosage and absorption is described. (R.V.J.)

13966

A SURVEY OF DOSIMETRY METHODS. Zdeněk Spurný (Inst. of Nuclear Research, Prague). Jaderná energie 6, 83-8(1960). (In Czech.)

A survey and a short evaluation are given of all up-to-date known methods of detecting and measuring ionizing radiation. (auth)

13967

RADIATION PROTECTION IN REACTORS AND IN NUCLEAR ENGINEERING PLANTS. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnik 2, 95-7(1960) Mar. (In German)

The scintillation detector and its application in radiation protection is described. (tr-auth)

13968

HYGIENIC REGULATIONS FOR THE LOCATION OF COBALT AND ROENTGEN APPARATUS. G. I. Meleshko (Ukrainian Scientific-Research Inst. of Communal Hygiene). Med. Radiol. 5, No. 3, 52-6(1960) Mar. (In Russian)

Data are given on the influence of cobalt and roentgen apparatus on the increase of the gamma background. It is shown that cobalt and roentgen apparatus exert an influence on the intensity of the natural gamma background up to 100 meters from the external wall of a building in which it is housed. The intensity of the radiation to a considerable measure depends upon the area of the windows and the height of windowsills. (auth)

13969

ON THE PROTECTION OF PERSONNEL IN RADIOLOGICAL DEPARTMENTS WORKING WITH CLOSED GAMMA-EMITTERS. A. M. Levit (Roentgen-Radiological Center of Kishinev Republic Hospital, USSR). Med. Radiol. 5, No. 3, 56-61(1960) Mar. (In Russian)

The problem is presented of maximal protection of personnel and patients from gamma-irradiation during the construction of a radiological department at the Republican Oncological Dispensary in Kishinev. (auth)

13970

THE ARTIFICIAL RADIOACTIVITY OF THE AIR IN AACHEN ON APRIL 1, 1958. H. Israël. Meteorol. Rundschau 12, No. 4, 136(1959). (In German)

On April 1, 1958, in Aachen, a sudden increase of the radioactivity of the air was observed. From measurements made on the decay of the aerosols, which followed the t^{-1} law, the origin of the activity was found to be March 6, 1958. An autoradiographic investigation of the filter parts showed that the activity was caused by a single strongly irradiating particle. The autoradiographs obtained from the particle are shown. (J.S.R.)

13971

PROTECTION MEASUREMENTS AGAINST IONIZING RADIATIONS IN ITALY. F. Fossati (Ospedale Maggiore, Milan). Minerva nucleare 4, 1-5(1960) Jan. (In Italian)

A brief account is given of the regulations in force in Italy in the field of radiation protection. These regulations are discussed with a special consideration of their deficiencies with respect to the present widespread use of ionizing radiations for industrial and for scientific, biological, and medical purposes. The present situation and possible future developments are discussed with the reminder that it would be advisable that excessively restrictive enforcing, or detailed regulations be avoided and that this problem should not involve too many authorities so that lack of coördination would be avoided. The utility of combining technical recommendations and regulations with suitable education and training of technicians and the public is discussed. (tr-auth)

13972

THE EVALUATION OF THE RADIATION DOSE ABSORBED FOR MEDICAL REASONS BEFORE ADDITIONAL EXPOSURE. L. Papagni and B. Roseo (Ospedale Maggiore, Milan and Università, Milan). Minerva nucleare 4, 6-10 (1960) Jan. (In Italian)

The various aspects of the problem of the evaluation of the dose of radiations absorbed for medical reasons before additional medical exposure are examined. At present, it cannot be excluded that, in the case of certain harmful effects, such as the production of leukemia, the absorbed doses act independently of their chronological distribution. Considerations of the tabulated characteristic values demonstrate the possibility that certain individuals having undergone x-ray diagnostic procedures or therapeutic irradiation, especially if often repeated, may have absorbed relatively high doses of radiations. This consideration should induce the physician to obtain a careful "x-ray history" in persons exposed to irradiation for professional reasons. The numerous technical and methodological variations make it difficult to appraise the dose absorbed for medical reasons *a posteriori*. (auth)

13973

THE MEASUREMENT OF NEUTRON DOSE. Arnold Clare (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Power 5, No. 49, 117-18(1960) May.

Techniques for the measurement of neutron doses in man are studied by varying the factors determining the maximum permissible flux (mpf). Values of mpf are given for neutron energies ranging from thermal to 10 Mev. The effect of accompanying gamma radiation on dose measurements can be reduced in two ways. Problems associated with the three ranges of neutron energies, e.g., finding proportional detectors, are discussed. (D.L.C.)

13974

THE INTERNATIONAL ORGANIZATION FOR THE PROTECTION OF PEOPLE SUBJECTED TO THE ACTION OF IONIZING RADIATION DURING THEIR WORK. Josef Kotek. Prace Bezpecnosti a hyg. 8, 274-6(1958). (Translated from Referat. Zhur. Khim. No. 10, 1959, abstract No. 35386).

The following maximum admissible doses of radiation were established within the limits of the control zone (in bars): for the whole body during an entire lifetime, 200; up to 30 years of age, 50; average per year for the whole body, 5; per week, 0.3; in cases where the worker received a greater dose during one week, the highest dose during the next 13 weeks must not exceed 3; in cases of weak external irradiation, the highest admissible dose must not exceed 1.5 a week and 15 during 13 weeks. The range of intensity of IR must not exceed 10% of the established rate. The rules governing work with the sources of IR, and technical requirements, established by the Commission, are as follows: proper planning of industrial buildings, screening of the sources of IR and others, protective appliances, observance of rules of personal hygiene, constant control of the intensity of IR, prohibition to accept people for work connected with IR when they are under 18 years of age, medico-professional selection, and so on.

13975

RADIATION PROTECTION STANDARDS. Lauriston S. Taylor (National Bureau of Standards, Washington, D. C.). Radiology 74, 824-31 (1960) May.

A review is presented of criteria for radiation protection standards. Permissible dose levels are discussed. (C.H.)

13976

PERSONNEL MONITORING WITH LARGE LIQUID SCINTILLATION COUNTERS. Marvin A. Van Dilla and Ernest C. Anderson (Los Alamos Scientific Lab., N. Mex.). U. S. Armed Forces Med. J. 11, 525-34(1960) May.

Three large liquid scintillation counters for people were developed and built. Characteristics are summarized. Results are reviewed after operation for a two-year period. (C.H.)

13977

American Assn. for the Advancement of Science, Washington, D. C.

LOW-LEVEL IRRADIATION. Austin M. Brues, ed. Publication No. 59. 154p. $3.75.

Eight papers presented at a symposium on low-level irradiation at Indianapolis, Indiana, in 1957 are contained. The natural and artificial radiation background of man is discussed. The genetic and somatic effects produced in man by low-level radiation are described. The analysis of fall-out distribution by meteorological theory is discussed. Radiation as a public health problem is considered. (C.J.G.)

13978
PHYSICAL REMOVAL OF RADIOACTIVE SURFACE CONTAMINATION FROM AGRICULTURAL LAND. Ronald G. Menzel and Paul E. James (U. S. Dept. of Agriculture, Beltsville, Md.). p.45-59 of "Proceedings of the Thirty-fifth Annual Meeting of the National Joint Committee on Fertilizer Application [held at] Cornell University, Ithaca, N. Y., June 23, 1959." Washington, D. C., National Plant Food Institute, 1959.

Field experiments were conducted to measure the effectiveness of decontamination of agricultural land by removing sod, crops, mulches, and surface soil. The contamination was applied by spraying solutions of short-lived radioisotopes onto the surfaces. Over 90 percent decontamination was achieved by raking off straw mulches of two tons or more per acre, or by cutting and removing sod. About 33 percent decontamination was achieved by mowing and collecting young soybean or Sudan grass crops. Over 98 percent decontamination was achieved by scraping off three to four inches of surface soil when the surface was relatively smooth prior to contamination. The use of asphalt coatings on the soil in conjunction with scraping was of no benefit. (auth)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

13979 CEA-1271
France. Laboratoire National d'Hydraulique, Chatou *and* France. Commissariat à l'Energie Atomique, Paris.
L'ETUDE DU TRANSPORT LITTORAL PAR LA METHODE DES TRACEURS RADIOACTIFS. (Beach Sediment Drift Study by Means of Radioactive Tracers). Pierre Jaffry and Richard Hours. 1959. 35p.

The present state of the sediment drift studies by means of radioactive tracers is exposed. Various processes of labeling, immersion, and detection, used in France and other countries, are reviewed. (auth)

13980 MLM-1040
Mound Lab., Miamisburg, Ohio.
DETERMINATION OF THE LIQUID LEVEL IN A STEEL CYLINDER BY GAMMA ABSORPTION. E. H. Daggett, J. M. Goode, J. W. Heyd, and R. L. Shipp. Sept. 22, 1952. 15p. Contract AT 33-1-GEN-53. OTS.

The experiments and calculations show that use of gamma radiation in measurement of the water level inside a 5-inch outside diameter by $2\frac{1}{2}$-inch inside diameter steel tank is feasible. The experimental work indicated that a reduction in gamma-ray intensity of approximately 23%, due to the addition of water inside the cylinder, could be achieved, and measurements of water level with a precision of $\pm\frac{1}{4}$ inch could be attained. The calculations show that a reduction in gamma-ray intensity of 34% due to the addition of water inside the cylinder is theoretically possible; hence, the experimental reduction factor was 68% of the calculated reduction factor. A neutron source and a boron-wall type neutron counter (wherein water serves as the neutron moderator) could be used in this liquid-level-measurement application, but the more complicated instrumentation and increased personnel hazards make this measurement system less desirable. (auth)

13981 NP-8642
Michigan. Univ., Ann Arbor. Fission Products Lab.
HIGH RADIOPASTEURIZATION OF FOODS. Report No. 7 (Final) [for] Period September 21, 1957 to December 2, 1958. Lloyd E. Brownell and Leon Ezman. 30p. Project No. 7-84-01-002. Contract DA-19-129-QM-1069. (UMRI-2718-7-F).

Tomato or tomato products were found to eliminate off-flavors in irradiated cooked beef and cheese dishes. An attempt was made to isolate the protective factor. Data are tabulated on the chemical and vitamin composition of tomatoes. From the results of tests it appeared that a water solution of dextrose has an effect similar to filtered liquid from tomato juice in the elimination of off-flavor in ground beef. A better product was obtained by simultaneous heating and gamma irradiation. Beef and tomato dishes baked in an electronic range had a longer shelf life than did conventionally prepared food. It was concluded that greater penetration of the tomato materials under microwave heating may be responsible. Additions of .15% α-tocopherol acetate resulted in a slight improvement after one week of storage. (C.H.)

13982 NP-8643
Michigan State Univ., East Lansing.
ENZYME INACTIVATION STUDIES ON IRRADIATION STERILIZED MEAT. Report No. 7 (Final) [for] Period April 12, 1958 to June 26, 1959. A. M. Pearson. 22p. Project No. O.I. 6118. Contract DA-19-129-QM-1144.

The method used in cooking had no effect on the palatability of irradiated beef and pork. Unirradiated samples were preferred over irradiated samples by all members of taste panels. Raw irradiated beef and pork were stored up to 32 days with little adverse effect on panel scores. A pH of 5.45 and heat inactivation either before or after irradiation improved the flavor of ground beef held in the frozen state for periods of from one to four months. Texture ratings were closely related to panel scores with soft and crumbly samples being rated lowest. Irradiation of beef and pork resulted in an increase in percentage of amino nitrogen. Inactivation of enzymes by high temperatures was effective in preventing any further increase in amino nitrogen during storage. (C.H.)

13983 NYO-2606
Air Reduction Sales Co. Central Research Labs., Murray Hill, N. J.
FISSION PRODUCT APPLICATIONS USING GASEOUS BETA SOURCES. Fourth Quarterly Progress Report [for] December 1, 1959 to February 29, 1960. Hoke S. Miller and John H. Zufall. 20p. Contract AT(30-1)-2343. OTS.

In tests on the polymerization of styrene in various phases, fission product krypton was recovered at an average efficiency of greater than 97%. Greatest utilization of the krypton radiation was achieved in tests in the liquid phase, in which production rates as high as 6.79 grams of polymer per curie per 24 hours of operation were obtained corresponding to a G-value of 5,312. On the basis of this performance 1 megacurie of Kr-85 could produce 5,625,000 pounds of polystyrene per year. The effect of fission product krypton on the breakdown voltage of members of the rare gas group of elements, nitrogen, and oxygen is no different than that of an equal volume of atmospheric krypton. (For preceding period see NYO-2605.) (auth)

13984 ORO-257
North Carolina State Coll., Raleigh. Textile Research Center.
APPLICATIONS OF NUCLEAR RADIATION AND RADIOISOTOPES TO TEXTILE MATERIALS AND PROCESSES. Annual Report for the Period November 1, 1958 to November 1, 1959. 72p. Contract AT(40-1)-2477. OTS.

Research on modification of textile fibers by naked exposure to radiation is described along with fiber modification by *in situ* polymerization and/or graft polymerization of vinyl monomers. In preliminary work, the rate at which a number of textiles were changed by gamma radiation was determined. Data on gamma radiation effects are included for rayon, acetate, Dacron, nylon 66, Orlon, Polypropylene, wool and silk. The behavior of several monomers during gamma irradiation was also investigated. Acrylonitrile was selected for experiments to establish principles or techniques for application of vinyl compounds to fibers. Data are given on addition of acrylonitrile to cotton under various conditions, as well as on the addition to other fibers under irradiation conditions and as a function of time. In research on beta gage applications, fabric uniformity studies were conducted on various cotton fabrics and data on fiber weight determined non-destructively are given. In research on activation analysis the general problem of fiber and yarn identification was investigated with the purpose of establishing characteristic gamma energy spectra for various fibers. By use of such data it is possible to differentiate fibers from one another and also fibers similar in composition but manufactured at different plants by the same producer, and fibers similar in composition produced by different manufacturers. Samples were irradiated by thermal neutrons at 2×10^8 neutrons/cm^2/sec. The resulting spectra are discussed and it is noted that the present data indicate that the techniques may be useful; however, new lots of fiber should be examined to confirm current findings. (J.R.D.)

13985

A COBALT-60 IRRADIATION FACILITY. F. G. Rice and W. D. Smythe (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Ind. Eng. Chem. 52, No. 5, 47A-49A(1960) May.

A compact irradiator requiring no auxiliary shielding and delivering exposure rates up to 1.9×10^6 r/hr in a volume of 220 cubic inches is described. It consists of an annular cage holding the movable sample chamber and the source (20,000 curies Co^{60}), surrounded by a lead shield; the design is based on the fact that a stationary source requires less shielding. Its weight of 7600 lb gives a low weight to source capacity ratio. External field and dose measurements were made, and a graph of isodose curves is presented. (D.L.C.)

13986

RADIOMETER FOR FIELD USE. J. H. McGuire and H. Wraight (Dept. of Scientific and Industrial Research and Fire Offices' Committee, Boreham Wood, Herts, Eng.). J. Sci. Instr. 37, 128-30(1960) Apr.

A shielded, gold-disk radiometer, specially designed for field use, is described. It measures thermal radiation in the range 0.01 to 1.2 cal cm^{-2} sec^{-1}. The calibration is not greatly affected by ambient temperature or by prolonged exposure and the error introduced by winds of up to 25 mile/hr is less than 8%. (auth)

13987

PROCESSING BY IRRADIATION. I. STERILIZATION OF MEDICAL AND PHARMACEUTICAL PRODUCTS. D. B. Powell and B. A. Bridges (Wantage Radiation Lab., Eng.). Research (London) 13, 151-7(1960) Apr.

The lethal action of ionizing radiations on microorganisms and its application to the sterilization of pharmaceutical and medical products are discussed. (auth)

13988

THE USE OF GAMMA-IRRADIATION FOR PROLONGING THE STORAGE LIFE OF POTATOES. L. V. Metlitskii, B. A. Rubin, and V. G. Krushchev. p.212-19 of "Izuchenie Zhivotnogo Organizma. Rybnoe Khoziaistvo. Pishchevaia Promyshlennost'. Trudy Vsesoiuznoi Nauchno-Tekhnicheskoi Konferentsii po Primeneniiu Radioaktivnykh i Stabil'nykh Izotopov i Izluchenii v Narodnom Khoziaistve i Nauke, 2d, Moscow, 1957." Moscow, Izdatel'stvo Akademii Nauk SSSR, 1958.

The effect of γ rays on potato tissues was studied in order to devise methods for prolonging the storage life of potatoes. Although the sprouting of potatoes is connected with the synthesis of nucleic acids on the growth points, the action of ionizing radiation should slow down the DNA synthesis and its transformation into RNA. Immediately after irradiation, only a slight decrease of DNA and RNA was observed, but 1½ mo after irradiation the RNA content was 40% lower than that of nonirradiated potatoes. Pictures of potato tubers showed that after 12 mo storage, the nonirradiated potatoes had disintegrated into a root system, but those irradiated with a dose of 10,000 r were in perfect condition. From this investigation, it was recommended that (1) potatoes be irradiated briefly with measured doses of high intensity and stored outside the emission sources, and (2) the workers be shielded from the radioactive emission. (OID)

ISOTOPE SEPARATION

13989 TID-5753

Virginia. Univ., Charlottesville. Research Labs. For Engineering Sciences.

POTENTIAL OF THE SHORT BOWL GAS CENTRIFUGE FOR THE ENRICHMENT OF THE U^{235} ISOTOPE AS COMPARED WITH PUBLISHED FIGURES FOR GAS DIFFUSION. Gernot Zippe. Mar. 1960. 11p. Contract [AT(40-1)-2400]. (EP-2823-100-6OU). OTS.

An economic comparison was made between the use of the short-bowl gas centrifuge and gas diffusion for the enrichment of U^{235}. (C.J.G.)

13990 JPRS-2474

THE TEMPERATURE RELATIONSHIP OF THE COEFFICIENT OF NITROGEN ISOTOPE SEPARATION DURING THE CHEMICAL EXCHANGE BETWEEN AMMONIA AND A SOLUTION OF AMMONIUM NITRATE. V. Yu. Arlov and N. N. Tunitskii (Tunitsky). Translated from Zhur. Fiz. Khim. 30, 2085-9(1956). 10p. OTS.

The temperature coefficient, α, for N isotope separation by exchange between NH_3 gas at 100 mm Hg and 50% NH_4NO_3 solution was studied. It was found that with a temperature rise from 5 to 40°C, α goes from 1.014 to a maximum of 1.025. These results compared with calculations satisfactorily. (T.R.H.)

13991 JPRS-2519

A CHEMICAL METHOD FOR THE SEPARATION OF BORON ISOTOPES. G. M. Panchenkov, V. D. Moiseev (Moiseyev), and A. V. Makarov. Translated from Zhur. Fiz. Khim. 31, 1851-60(1957). 17p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 392.

13992

THE SPUTTERING EFFECT OF POSITIVE IONS WITH ENERGIES UP TO 25 kev IN A SMALL ELECTROMAGNETIC SEPARATOR. M. I. Guseva. Soviet Phys.-Solid State 1, 1410-14(1960) Apr.

A method is described for determining the sputtering effect of ions on copper and silver at 3 to 25 kev energies. The advantages are that the experiments are conducted in a high vacuum with strictly controlled ion-energy and -mass values, and accuracy of ion current measurements at the target. For low current densities at the target, the sputtering coefficient depends on the ion-current density. The penetration of the bombarding ions in the surface of the target material makes possible the direct preparation of isotope target in an electromagnetic separator. (B.O.G.)

13993

ON THE COEFFICIENT OF UTILIZATION OF ISOTOPE SEPARATION METHODS. A. N. Murin. Zhur. Fiz. Khim. 34, 231-3(1960) Jan. (In Russian)

Coefficients of utilization were correlated for thermal diffusion through porous media and isotope exchange. Correlations of the various methods are carried out with the maximum coefficient values for various single processes. (R.V.J.)

13994

THE McCABE-THIELE DIAGRAM FOR ISOTOPE SEPARATION AND A GENERAL FORMULA FOR THE PLATE NUMBER FOR EXCHANGE COLUMNS. Manfred Dietz and Siegfried Pilz (VEB KIB Chemie, Leipzig). (In German)

In an earlier work (Chem. Tech. 11, 544(1959)) general fundamentals for the mathematical formulation of deuterium exchange and rectification processes were established. In the present work differences in the McCabe-Thiele diagram for rectification and isotope separation are indicated, and the essential relations are given. The relationship between atomic fraction and mole fraction, separation factor, and equilibrium constants and the introduction of corrected values are considered, The reflux ratio in the hot-cold exchange was investigated, and its variation range is given and distributed to six variants of the chemical exchange. Basic equations are introduced which permit a consideration of the processes and ratios in the deuterium exchange independently of the exchange system used. A formula for the plate number of an exchange column, in which a linear work curve and equilibrium curve are assumed, is derived. By specialization, the formula of the plate number for the usual deuterium exchange systems with their six variants is obtained from this relationship. On the basis of the assumptions used in the derivation of the formula for the plate number, an extension of its validity to rectification and extraction is possible. (tr-auth)

MATHEMATICS AND COMPUTERS

13995 AD-228713

Wisconsin. Univ., Madison. Mathematics Research Center.

ON A SYSTEM OF INTEGRODIFFERENTIAL EQUATIONS OCCURRING IN REACTOR DYNAMICS. MRC Technical Summary Report No. 103. J. J. Levin and J. A. Nohel. Sept. 1959. 29p. Contract DA-11-022-ORD-2059.

The existence, uniqueness, and asymptotic behavior are studied (as $t \to \infty$) of the solution of the real system $du/dt = -\int_{-\infty}^{\infty} \alpha(x)T(x,t)dx$, $a\,\partial T/\partial t = b\,(\partial^2 T/\partial \times \partial) + \eta(x)u$. The system describes the linearized dynamic model of a continuous medium nuclear reactor. (W.D.M.)

13996 CERN-60-7

European Organization for Nuclear Research, Geneva.

A COMPUTER PROGRAM FOR LEAST-SQUARED-FIT OF POSITION OF ONE OR MORE CAMERAS USING FILM MEASUREMENTS OF FIDUCIAL MARKS. B. Böck. Mar. 11, 1960. 8p.

A computer program for least-squares fit to determine the position of one or more cameras for film measurement of fiducial marks is presented. (auth)

13997 CF-60-4-69

Oak Ridge National Lab., Tenn.

GAP: THE IBM 704 GRID ANALYSIS PROGRAM. F. J. Witt. May 2, 1960. 18p. Contract [W-7405-eng-26]. OTS.

A description is given of GAP, an IBM 704 program for analyzing simply-supported rectangular beam grillages in which the beams intersect at right angles. The grillage need not be symmetrical and may have both uniformly distributed and concentrated loads. The individual beams may have arbitrary cross sections. Strain energy methods are used to determine the bending, shearing, and torsional effects in a given grid structure. Deflections and moments can be found directly by the program. Series coefficients are provided for additional computation. (auth)

13998 CRT-916

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ACE—AN ALGEBRAIC COMPILER AND ENCODER FOR THE CHALK RIVER DATATRON COMPUTER. J. M. Kennedy, E. A. Okazaki, and M. Millican. Mar. 1960. 35p. (AECL-996). AECL.

A program is described for a Burroughs 205 computer which enables the machine to compile data for solving problems from instructions supplied by the user in a notation related more closely to algebra than to the machines own code. (J.R.D.)

13999 ORNL-2925

Oak Ridge National Lab., Tenn.

NUCLEAR DATA PROCESSING ON AN IBM-704 COMPUTER WITH THE CONDAC PROGRAM. C. D. Goodman and B. D. Williams. May 11, 1960. 31p. Contract W-7405-eng-26. OTS.

A description of the CONDAC program, written for the IBM-704, is given. CONDAC performs nuclear data reduction of the type: pulse-height spectra of the energy distribution of charged particles as measured by an energy-sensitive detector. The preparation of data is described, and operator instructions are given. (C.J.G.)

14000 UCRL-5817

California. Univ., Livermore. Lawrence Radiation Lab.

TABLE OF LEGENDRE FUNCTIONS OF THE SECOND KIND, $Q_n(X)$. Bradley M. Johnston. Jan. 1960. 24p. Contract W-7405-eng-48. OTS.

A table of Legendre functions of the second kind for arguments greater than unity was prepared. For arguments near unity, the recurrence formulas were used. These formulas were used for X between 1.001 and 1.024. The series of Hobson was used for X between 1.025 and 30 with twenty-five terms of the hypergeometric series. (W.D.M.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

14001 BMI-1381

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING SEPTEMBER 1959. Russell W. Dayton and Clyde R. Tipton, Jr. Oct. 1, 1959. Decl. Nov. 4, 1959. 95p. Contract W-7405-eng-92. OTS.

Tentative creep data are reported for annealed Zircaloy-2 sheet. A program directed toward the development of corrosion-resistant welding alloys for use with vacuum-melted low-carbon Hastelloy F to contain HAPO spent-fuel-element decladding solutions was initiated. Research to develop more satisfactory fuels from the Al—U system is reported. The development of a radiometric method for the determination of CaO in Portland cement was completed. In the study of radiation-induced nitration of hydrocarbons, a series of thermal and irradiation runs was completed in the liquid phase of the HNO_3—cyclohexane system. An exploratory investigation is being conducted to determine the effects of ultra-high pressure and high temperature on uranium oxides and on the reactions of uranium oxides with mixed oxides. The irradiation-surveillance program was continued on type 347 stainless steel. Tensile data are reported for Nb-base alloys. A summary is reported of corrosion results obtained on Nb alloys exposed in high-temperature water and steam. The creep properties of Zircaloy-2 during irradiation at elevated temperatures are being investigated. Corrosion data are reported for Nb—U alloys exposed to high-temperature water and NaK. A program devoted to the determination of causes of fission-gas release in UO_2 is reported. Cermet and ceramic-type fuels are being clad with Mo and Nb by the gas-pressure-bonding technique. Data are reported on the densification of UO_2 by various pressure-bonding conditions. Methods of producing dense UC pellets by powder-metallurgy methods are being investigated. Techniques for the production of high-quality cast shapes of UC are being developed. The rates of interdiffusion of U and C in the U—monocarbide-dicarbide system and the rates of self-diffusion of U and C in UC are being investigated. Hydrogen migration in Zr under the influence of a thermal gradient is being studied. Neutron-activation and in-pile experiments are being conducted to determine fission-gas retention and the effect of radiation on fueled-graphite spheres. Chemical analysis of cold-rolled binary Ta alloys is reported. Data are presented on the fission-gas release from UC—graphite, UC_2—graphite, and UO_2—BeO specimens during postirradiation heat treatment in vacuum at 1800°F for 24 hours. Techniques are being developed for the fabrication of fuel elements, suppressor components, and control rods for the SM-2 reactor. Studies directed toward the development of compact gas-cooled reactors are reported. Research on core materials in support of the MGCR program is in progress. (For preceding period see BMI-1377.) (W.L.H.)

14002 BMI-1391(Rev.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING OCTOBER 1959. Russell W. Dayton and Clyde R. Tipton, Jr. Nov. 1, 1959. 98p. Contract W-7405-eng-92. OTS.

The creep properties of 15% cold-worked Zircaloy-2, as evident from results being obtained, are superior to those of the annealed Zircaloy-2 at test temperatures of 290, 345, and 400°C. The development of a fuel-element leak detector was continued with studies to determine the effect of AgBr concentration and the flow rate of the I^{131} solution on the exchange between solid AgBr and I. Modification and improvement of a thermal-neutron-flux monitoring system for application to the Hanford reactors were continued. A program is reported for the development of corrosion-resistant welding alloys for use with vacuum-melted low-carbon Hastelloy F when used as a container material for spent fuel-element decladding solutions. Aluminum—uranium alloys containing 0.5 to 3.0 wt.% Sn or Zr are being evaluated for possible use as reactor fuels. Additional activation analysis was performed on three samples of cement raw materials. Analyses for manganese and sodium were completed. Current work on the intrinsic-radiotracer process-control application has dealt with the problem of Fe removal from refinery streams. An investigation is being conducted on the effects of oxide additions to UO_2, relative to stabilization toward oxidation and volatilization. An irradiation-surveillance program concerned with the effects of irradiation on the mechanical properties of AISI Type 347 stainless steel is reported. Evaluation is being made of several Nb-base alloys which should possess better properties than a V—10 wt.% Ti—1 wt.% Nb alloy (an acceptable cladding material for the EBR). The evaluation of selected Nb-base alloys for service in pressurized-water reactors was continued. An investigation of the creep properties of Zircaloy-2 during irradiation at elevated temperatures is being made. An investigation of the fabrication characteristics, mechanical and physical properties, and corrosion behavior in various media of Nb—U alloys is being made to determine their applicability as reactor fuels. Thorium—uranium and thorium—uranium-base alloys are being investigated with the aim of improving their irradiation stability and corrosion resistance. A program aimed at investigating Pu-alloy systems for possible fuel materials is being planned. In an attempt to develop alloys for application at reasonably high temperatures, Zr—Nb—Pu and U—Nb—Pu alloys will be investigated. Preparations for study of the important mechanisms of gas release in UO_2 are in progress. This study will include both a determination of diffusion coefficients in UO_2 specimens of known geometry and use of these data in an in-pile study of gas release from sintered UO_2. Evaluations of fabrication techniques for producing UO_2—Mo and UO_2—Nb cermets of 90% theoretical density or better containing 60 to 90 vol.% fuel are being made. Investigations of gas-pressure bonding of Mo- and Nb-clad fuel elements were continued. The uranium carbides and particularly uranium monocarbide are being developed for use as power reactor fuels. A program is reported for the preparation of UC bodies by powder metallurgy processes. Reliable techniques for the production of high-quality cast shapes of UC are being developed. A fundamental investigation is being made of the reactions of N_2 with Nb. A program was initiated to produce UO_2 crystals by the process of vaporization. Another investigation was made to grow monocrystals of UO_2 by the use of fusion methods. Research on core materials in support of the MGCR program is in progress. The major effort is on the development and evaluation of UO_2 dispersions in BeO and dispersions of UC and UC_2 in graphite, and on the cladding of UO_2 particles with BeO. The development of fuel, absorbers, and suppressor materials for the SM-2 is reported. (For preceding period see BMI-1381.) (W.L.H.)

14003 HW-64359
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SPECIFICATIONS FOR SWAGED UO_2 19-ROD CLUSTER, PRTR FUEL ELEMENT MARK I. M. K. Millhollen. Mar. 15, 1960. 28p. Contract AT(45-1)-1350. OTS.

The first UO_2 fuel loading for the Plutonium Recycle Test Reactor consists of Zircaloy-2 clad, swaged, 19-rod cluster fuel elements. These fuel elements are unique in that they represent the first large-scale demonstration of the use of a combination of (1) non-sintered, swaged fuel in a high temperature reactor and (2) non-segmented, long fuel rods employing unbonded wire wrap spacing members to control cluster geometry. During the fabrication of these fuel elements, specifications governing several aspects of the process were developed. Specifications which are directly applicable to the current PRTR design can be extended to include similar rod cluster designs. (auth)

14004 IS-107
Ames Lab., Ames, Iowa.
URANIUM GLASSES. I. FUNDAMENTAL CONSIDERA-

TIONS. C. D. Wirkus and D. R. Wilder. Feb. 1960. 19p. Contract W-7405-eng-82. OTS.

The principles involved in forming glasses containing uranium are discussed. Materials having low thermal neutron cross sections that could be useful components in a uranium glass are listed and their properties are discussed. (auth)

14005 MND-AC-1755-1
Martin Co. Nuclear Div., Baltimore
COATED PARTICLE INVESTIGATION. Final Summary Report. Volume I. David Goslee. Apr. 1959. 63p. For Allis-Chalmers Mfg. Co. Nuclear Power Div. Contract AT(11-1)-589 with Northern States Power Co. OTS.

A program designed to determine the feasibility of vapor plating continuous metal coatings of zirconium onto individual particles of UO_2 is described. It was found that zirconium can be plated onto UO_2 particles by magnesium reduction of zirconium tetrachloride. The process appears to proceed faster under system pressures of 20 to 30 microns. At the vapor plating temperatures investigated, the deposition rates were found to be low; however low-temperature, long-time plating operation should yield greater quantities of zirconium coating and at the same time decrease the tendency for reaction between the ceramic and its coating. (J.R.D.)

14006 MND-M-1911
Martin Co. Nuclear Div., [Baltimore].
SELECTION OF 347 STAINLESS STEEL FOR USE IN THE PM-1 REACTOR PRESSURE VESSEL. C. Canitz. Nov. 1959. 5p. (RJA-3). OTS.

The reasoning involved in the selection of Type 347 stainless steel to conform to ASME Specification SA-240 as the austenitic steel to be used in the PM-1 pressure vessel is discussed. (W.D.M.)

14007 MSAR-60-49
MSA Research Corp., Callery, Penna.
PROGRESS REPORT 57 FOR FEBRUARY AND MARCH 1960. W. J. Posey, ed. Apr. 15, 1960. 34p. Contract NObs-77023.

Experiments are reported in which Inconel pipe specimens were exposed for 1000 hours in a high-humidity sea water-warm air compartment. Constant-temperature specimens were held at 400, 200, 165, and 125°F while cyclic specimens were varied between 550 and 125°F. Results indicate that Inconel is a better choice for piping material for use in high salinity and humidity than is stainless steel. Blowdown tests to determine where flashing occurs and to study the effects of various orifice lengths where the flashing occurs are scheduled. Other investigations for which reports have been published include investigations on film boiling and solution rates of gases in water systems. Data from an evaluation of decontaminating solutions used for electrolytic descaling indicate that citric acid used as an electrolyte was less effective than sulfuric acid or an alkaline cleaner. Other cleaning and decontaminating procedures involving solutions, abrasive slurries, and ultrasonics are discussed and evaluated. (For preceding period see MSAR-60-16.) (J.R.D.)

14008 NAA-SR-Memo-3889
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HNPF—PRESSURE BUILD-UP AND GAS SPACE REQUIREMENTS OF THE U—10 w/o Mo FUEL ELEMENTS. H. L. Sletten and A. Musso, Jr. May 20, 1959. 18p. OTS.

The length of gas space required above the fuel inside the "hottest" rod of a 19-rod core design with U—10 wt.% Mo fuel was determined when the rod is cold and nonirradiated. Curves are presented which show the variation in gas space required as a function of allowable gas pressure. Results are presented for the gas space requirements of a rod in a 14-rod, cored-slug, alternate U—10 wt.% Mo fuel element design. (C.J.G.)

14009 NDA-2116-4
Nuclear Development Corp. of America, White Plains, N. Y.
CONCEPTUAL DESIGN AND ECONOMIC STUDY, URANIUM SPONGE FUEL DEVELOPMENT. G. A. Sofer and M. Raber. Jan. 31, 1960. 57p. Project III. Contract AT(30-1)-2303. OTS.

The economic feasibility of substituting uranium sponge fuel for the U—10 wt.% Mo and UC fuels being considered for the Hallam Power Reactor and the Fermi Fast Breeder Reactor was evaluated. The effect of the thermal characteristics of sponge fuel on the number and size of the fuel rods required was studied. The nuclear characteristics of these reactors when fueled with sponge elements were calculated. (C.J.G.)

14010 NP-8568
Narmco Industries Inc., San Diego, Calif.
DEVELOPMENT OF EXO-REACTANT INORGANIC ADHESIVE SYSTEM. Quarterly Progress Report No. 2 Covering Period January 1—March 31, 1960. William Bassett and Roger A. Long. Apr. 1, 1960. 27p. Contract NOas-60-6061-c.

Further optimization of copper and silver—copper alloy exo-adhesives was studied with emphasis on reproducibility of results. Such results were achieved in test samples which exhibited greater than 4000 psi lap shear ductile bonding of stainless steel overlap specimens. Most lap shear test failures occurred in the stainless steel base metal. Heat treatment improved the base metal strength such that three specimens exhibited at least 9200 psi lap shear strength. At 1000°F copper-bonded specimen lap shear strength was lowered from a room-temperature value of 5880 psi to 2970 psi. (For preceding period see NP-8450.) (auth)

14011 OOR-2060.2
Brown Univ., Providence.
A MODIFICATION OF THE COULOMB-MOHR THEORY OF FRACTURE. B. Paul. Jan. 1960. 51p. Project No. DA-599-01-004. Contract DA-19-020-ORD-4888.

The inability of the Coulomb-Mohr theory of fracture to explain the main features of compression, tension, and torsion tests on brittle materials is pointed out. It is shown that the introduction of suitably chosen tension cut-offs and friction angles removes this deficiency and leads to a satisfactory explanation of the fracture stresses and angles of fracture for these three simple tests. The modified Coulomb-Mohr theory is a three-parameter theory, but all three parameters can in principle be obtained from only two simple tests. It is shown that in the case of cast-iron there is an extremely close relationship between cohesive resistance in shear and nominal ultimate strength in single or double shear. The three-dimensional fracture surface is described and used to explain some apparently anomalous points in the experimental data. A hypothesis is also advanced which explains the appearance of concavities in the yield locus for certain classes of materials. (auth)

14012 ORNL-910(Del.)
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1950. E. C. Miller and W. H. Bridges, eds. Feb. 8. 1951. Decl. with

deletions Oct. 19, 1959. 70p. Contract W-7405-eng-26. OTS.

Minor changes in materials and methods resulted in increased yields in the production of fuel elements for the Bulk Shielding Facility. Attempts to bond uranium to a mercury—silver alloy resulted in bonds of insufficient strength. Thorium alloys containing 2 to 4% Nb, Cr, Mn, Ti, Zr, Be, Al, and Si were prepared. The alloys containing Be, Al, or Si were hard, brittle, and not cold-workable. The alloys containing the other elements were cold-workable in the as-cast condition. Impact testing of pure thorium, using standard V-notch specimens, revealed a transition from brittle to tough behavior at 120 to 200°C. The determination of $UAL_4 : UAL_3$ ratios, lattice parameters, and microstructures for the Al—Si—U system is reported. It was found that for a 20% uranium alloy, only 0.8% Si is necessary to completely suppress the formation of UAL_4. In general, ferritic iron—chromium alloys appeared more resistant to static corrosion by 1000°C lithium and lead than did austenitic alloys. Compatability tests with combinations of Mo, UO_2, BeO, Nb, and stainless steels 309 and 316 are discussed. True stress-natural strain-time diagrams for copper at room temperature are presented. (See also ORNL-2839.) (C.J.G.)

14013 ORO-266
Union Carbide Metals Co., Niagara Falls, N. Y.
COLUMBIUM-CLAD URANIUM CARBIDE FUEL ELEMENT CONTRACT. Monthly Letter Report [for] February 1 through February 29, 1960. J. J. Finley, M. Korchynsky and S. Sarian. 5p. Contract AT(40-1)-2559. OTS.

In the production of UC further studies were made of the reaction of metallic uranium with methane gas. Data are also presented on cold-pressing, hot-pressing, and sintering of uranium monocarbide. Preliminary studies were made on the reaction of UC with Nb-base alloys at 1100°C. (W.L.H.)

14014 WADC-TR-58-51(Pt.III)
Illinois. Univ., Urbana.
HIGH POLYMERIC MATERIALS. Period covered: February 1, 1959 to January 31, 1960. Carl S. Marvel, Ludwig F. Audrieth, T. Moeller, and John C. Bailar, Jr. Jan. 1960. 138p. Contract AF33(616)-5486.

Further work on p-polyphenyl was initiated. The chloranil dehydrogenation of poly-1,3-cyclohexadiene was found to involve a complex interaction of the two materials rather than simple dehydrogenation. The cyclic intramolecular-intermolecular polymerization of diphenyl derivatives of 1,5-hexadiene, 1,6-heptadiene, and 1,7-octadiene was investigated. While new polymers with recurring cyclic units were obtained, their heat stabilities do not appear to be outstanding. A new type polymer which contains recurring benzene and thiazole rings has been prepared, and preliminary studies show these to be remarkably stable at 300°C. Some polymers with good inherent viscosities have been prepared but they have not yet been obtained in other than powder form. Other work on ethylene-anthracene copolymers, such as research on preparation of polyperhydro-naphthalene and a ladder type polymer with alternating benzene and pyridine rings, is reported. (auth)

14015 WADC-TR-59-526
Illinois. Univ., Urbana.
PROTECTIVE COATINGS FOR REFRACTORY METALS. [Period covered]: June 1958 to August 1959. Clifton G. Bergeron, Arthur L. Friedberg, Richard C. Anderson, Virgil E. Bradford, Doris M. Maroney, and Robert W. Bohl. Oct. 1959. 50p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5734. OTS.

Properties of tungsten and methods of applying protective coatings of high-temperature oxidation resistance are reviewed. Vitreous coatings of zirconia-based frits fired in air and flame sprayed alumina and zirconia base powders gave very little protection to the tungsten. Tests with tungsten encapsulated in evacuated fused silica tubes revealed that glassy materials were impermeable to oxygen above 3000°F for long periods of time. Zirconia-containing vitreous-bonded coatings, processed in argon, and zircon and zirconia crystallized glasses successfully withstood temperatures of 3000 to 3500°F for several hours. Siliconized coatings were most protective in regions where glass formation at the surface of the coating had been well developed. (C.J.G.)

14016 AEC-tr-4046
USE OF AN EQUILIBRIUM INVESTIGATION IN A FURNACE ATMOSPHERE AND PROBLEMS OF NON-DECARBURIZING AND BRIGHT ANNEALING. Gustav Neumann. Translated for Oak Ridge National Lab. from Arch. Eisenhüttenw. 14, 479-88(1941). 45p. (Includes original, 9p.). JCL.

Formulas for determining the constants for water gas, methane—water gas, oxidation-reduction, and carburization-decarburization equilibria in a furnace atmosphere were derived from oxygen and carbon vapor pressure conditions. (C.J.G.)

14017
ELECTROLYTIC LOCAL POLISHING FOR METALLOGRAPHY OF BERYLLIUM, ZIRCONIUM, AND MOLYBDENUM. Pierre-A. Jacquet. J. Less-Common Metals 1, 439-55(1959) Dec. (In French)

A new technique of electrolytic local polishing using a plug which acts both as a mobile cathode and as a container for the electrolyte is described. This development provides great advantages compared with classical methods of electrolytic polishing using a simple cell or semi-automatic apparatus and also suits nearly every metallic material, whatever the shape and dimensions of the specimen or part to be examined. The present paper is limited to the operating conditions, and some results obtained, for beryllium, zirconium, zircaloy-2, and molybdenum. Brief reference is also made to the varnish replica technique for the examination of large or complicated samples by optical or electron microscopy. (auth)

14018
METALLOGRAPHIC MICROSCOPE FOR ACTIVE SAMPLES. J. Bloch and G. Cherel (Centre d'Études Nucléaires, Saclay, France). Tech. moderne 50, No. 9, 2p. (1958) Sept. (In French)

A metallographic microscope for the examination of irradiated nuclear fuel has been in use since September 1955 in the High Activity Laboratory of the Centre d'Études Nucléaires at Saclay. It was designed for samples having an activity lower than 10 curies, and with it one can examine the uranium of the sets of rods from the pile EL2 after three months of "cooling." To give an idea, 10 g of uranium, after six months in a pile such as G1, have an activity of about 10 curies on removal from the pile. Two completely remote-controlled microscopes are being built, and will be installed in the new 10 kilocurie laboratory at present in the course of construction. It will be possible to examine samples with an activity of the order of 1000 curies, which means that enriched uranium irradiated in the high-flux pile EL3 will be able to be examined after three months of cooling. The modifications carried out on these microscopes are of two kinds: those carried out on the optics of the instrument, in order to bring the image outside the protection enclosure (these can be dispensed with by using television); and those carried out on the mechanical part of the system, to provide remote control for the various routine operations in metallography. The existing set-up and the proposed installation destined for the very High Activity Laboratory are described. (auth)

14019

ON THE ELIMINATION OF SODIUM OXIDE FROM ALUMINA DURING ITS FUSION. F. Trombe and M. Foex (Centre National de la Recherche Scientifique, Mont-Louis, France). p.117-30 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

A study was made of the preparation of alumina free from sodium oxide with commercial alumina as the starting product. The analytical problems consist in the determination of the sodium oxide and the determination of β alumina. The control methods used are described. In the fusion of the commercial alumina in a centrifugal solar furnace, the sodium oxide evaporates. The presence of certain reagents accelerates the process. Various impurities impede the evaporation of sodium oxide and the formation of β alumina. The effects of silica, titanium oxide, calcium oxide, ferric oxide, and vanadium oxide were investigated. (J.S.R.)

14020

THE OBTENTION OF MANGANESE BY DISTILLATION OF INDUSTRIAL ALLOYS. M. E. Bonnier (Laboratoire de l'E.N.S. d'Electrochimie et d'Electrometallurgie, Grenoble, France). p.153-76 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

An attempt was made to distill Mn from Fe−Mn−Si ternary mixtures by taking advantage of the affinity existing between Fe and Si to separate Mn. The thermodynamic solution to this problem was first investigated to determine the most favorable approach. From the theoretical calculations and published data the isoactivity curves of the constituents of the Fe−Mn−Si system were set up. The fusion heat of FeS and the free formation enthalpy of $Fe_{12}Si_{11}Mn_5$ were recalculated. From the curves obtained it was evident that at 1600°K under a total pressure of 1 μ of Hg a high proportion of manganese can be extracted from large quantities of Fe and Si. The presence of C even in small quantities, however, limits the extraction of Mn. The experimental results concern the theoretical predictions on the rate of extraction of Mn, which exceeds 90% with less than 0.2% Fe and 0.1% Si in the evaporated metal. The presence of carbon is inevitable if carburated metals are the starting materials, but it does not exceed 0.04%. (J.S.R.)

14021

ELECTRODEPOSITION OF URANIUM COMPOUNDS. (to United Kingdom Atomic Energy Authority). British Patent 832,494. Apr. 13, 1960.

An electrolytic method is given for preparing uranium samples for isotopic analysis. A bright Pt disk cathode is placed on a Pt plate on a glass base, and a glass cylinder is sealed to the glass plate by beeswax. The cylinder is filled with 0.03M NaF solution into which the $UO_2(NO_3)_2$ sample is placed. The Pt wire anode-stirrer is turned on and a potential of 7 volts applied at 50 ma. The deposition will be complete in about 90 min. (T.R.H.)

14022

IMPROVEMENTS IN OR RELATING TO METAL COATINGS. Leslie Mark Wyatt. (to United Kingdom Atomic Energy Authority). British Patent 832,807. Apr. 13, 1960.

A fuel cladding process and furnace are described. The cladding is applied by compacting metal powder around the fuel, sealing in a sheath, and subjecting to heat and gas pressure in a furnace. The process is especially suitable for Be cladding which is brittle and toxic. The furnace is enclosed in a pressure vessel which has a gland chamber for passing articles to be clad in and out of the furnace without depressurizing. The motor-driven mechanism for moving articles through the process is described. (T.R.H.)

14023

ZIRCONIA RODS FOR COATING ARTICLES BY FLAME SPRAYING. (to Norton Grinding Wheel Co., Ltd.). British Patent 833,107. Apr. 21, 1960.

An improved ZrO_2 rod for flame spraying guns is described which consists of a sintered ZrO_2 rod of mostly cubic and tetragonal crystals and has a porosity of 8% to 40% by volume. These rods are prepared by mixing 100 parts of ZrO_2 75 parts fused, stabilized, 216 μ size, containing 5% CaO, 15 parts fused, stabilized, 25 to 50 μ size, with 5% CaO, 10 parts fused, unstabilized lime-free with 17 parts water, 1 part dextrine, 2 parts corn starch, and extruding. They are then dried and fired in a kiln heated to cone 35 Orton. (T.R.H.)

14024

PYROMETALLURGICAL METHOD FOR PRODUCING PURIFIED URANIUM METAL. (to United States Atomic Energy Commission). British Patent 833,153. Apr. 21, 1960.

A pyrometallurgical process is described for treating irradiated fuel elements, purifying U, and reducing binary U compounds. According to the process, U is dissolved in Zn and UZn_9 is crystallized out, separated, and the Zn vaporized off. If the U occurs as UO_2 or UF_4, a Mg−Zn solvent is used to reduce to U metal. (T.R.H.)

Corrosion

14025 CRMet-911

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE CORROSION RESISTANCE OF Zr−Nb AND Zr−Nb−Sn ALLOYS IN HIGH-TEMPERATURE WATER AND STEAM. S. B. Dalgaard. Mar. 1960. 25p. (AECL-993). AECL.

An alloy of reactor-grade sponge zirconium−2.5 wt.% niobium was exposed to water and steam at high temperature. The corrosion was twice that of Zircaloy-2 while hydrogen pickup was found to be equal to that of Zircaloy-2. Ternary additions of tin to this alloy in the range 0.5 to 1.5 had no effect on the corrosion resistance in water at 315°C up to 100 days. At higher temperatures, tin increased the corrosion, the effect varying with temperature. Heat treatment of the alloys was shown to affect corrosion resistance. (auth)

14026 ORNL-2939

Oak Ridge National Lab., Tenn.

EFFECT OF HEAT FLUX ON THE CORROSION OF ALUMINUM BY WATER. PART I. EXPERIMENTAL EQUIPMENT AND PRELIMINARY TEST RESULTS. J. C. Griess, H. C. Savage, T. H. Mauney, and J. L. English. May 13, 1960. 46p. Contract W-7405-eng-26. OTS.

An experiment was performed to determine the effect of heat flux on the corrosion of 1100 aluminum by water under conditions simulating those that will exist in the High Flux Isotope Reactor. An a-c current was used to heat the test specimen, and a flow of water from a bypass line of a pump loop provided cooling. Water flowing at 33 ft/sec entered a coolant channel in the specimen at 155°F and was heated to 192°F on passing through the specimen. Heat fluxes of 0.50×10^6 and 1.62×10^6 Btu/hr·ft^2 on different parts of the specimen were constant during the 10-day test. The formation of adherent corrosion products on the coolant surfaces resulted in increasing aluminum temperatures as the test progressed. During the 10-day test the maximum temperature increase occurred at the coolant outlet and amounted to 189°F. In this region an adherent, nearly transparent, corrosion-product layer about 0.002 in. thick formed; the aluminum was penetrated to a depth of 0.007 in., 0.005 in. of which was intergranular in nature. The results of the test indicate that the temperature of the aluminum cladding on the fuel elements of the High-Flux Isotope Reactor will be higher than calculated, assuming clean aluminum surfaces, and that the extent of corrosion must be reduced either by the addition of inhibitors to the water or by the use of an alloy more corrosion resistant than 1100 aluminum. (auth)

14027 WADC-TR-59-205
Dayton, Ohio. Univ. Research Inst.
FURTHER INVESTIGATION OF THE EFFECTS OF MOLTEN BORON OXIDE ON HIGH TEMPERATURE MATERIALS. Joseph W. Rosenbery. May 1, 1959. 101p. Project title: AVIATION FUELS. Task title: FUEL SYSTEM MATERIALS. Contract AF33(616)-3898. OTS.

The corrosion resistance of a group of high-temperature materials, typical of those available for use in aircraft power plants, was evaluated in a boron oxide environment. Exposure consisted of cyclic immersion in B_2O_3 at 1750 to 2200°F for periods up to 145 hours in an air atmosphere. The results indicate aluminum, manganese, and carbon as alloy constituents are detrimental to corrosion resistance, while Si appears to produce beneficial effects. Several possible mechanisms of attack by molten boron oxide are postulated to explain the data. (auth)

14028
AUTOCLAVE TESTING OF ZIRCONIUM ALLOYS. Oliver Flint (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Corrosion 16, 229t-32t(1960) May.

No significant difference between water corrosion of American and British Zircaloy-2 at 320°C is observed when corrections for variations in autoclave testing techniques are made. Nitrogen contents up to 220 ppm can be tolerated in British Zircaloy without acceleration of attack. Mechanical polishing or the conventional nitric-hydrofluoric acid pickle, as pre-treatments prior to testing, appear to be equally efficient in minimizing corrosion effects. Welding does not impair corrosion resistance, provided the weld is "bright" as made and surface polished. A retest of material already taken beyond the transition point at which Zircaloy-2 corrosion rates become linear showed the characteristically low initial rate of the alloy control specimen in spite of the high hydrogen concentration generated in the first test. (auth)

14029
BOILER MODEL TESTS OF MATERIALS FOR STEAM GENERATORS IN PRESSURIZED WATER REACTOR PLANTS. E. Howells and T. A. McNary (Babcock and Wilcox Co., Alliance, Ohio) and D. E. White (Westinghouse Electric Corp., Pittsburgh). Corrosion 16, 241t-5t(1960) May.

An evaluation was made of various materials on the secondary side of boiler models built and operated in simulation of a full scale unit in a pressurized water nuclear power plant. Materials tested included stainless steel, carbon steel, Croloy 2$^1/_4$, Croloy 16-1, nickel, Inconel, and Monel. Considerable attention was given to problems involving stress corrosion cracking, particularly of Type 347 stainless steel tubing. Other topics discussed include control of dissolved oxygen concentration, pitting corrosion, and location of tubing areas most susceptible to corrosion. (auth)

14030
A STUDY OF THE COMPATIBILITY OF SOME CREEP-RESISTANT STEELS WITH LIQUID BISMUTH IN NON-ISOTHERMAL SYSTEMS. D. W. Dawe, G. W. Parry, and G. W. Wilson (Hawker-Siddeley Nuclear Power Co., Ltd., Langley, Eng.). J. Brit. Nuclear Energy Conf. 5, 24-9 (1960) Jan.

The compatibility of a series of low-carbon ferritic steels with liquid bismuth and the variation in their resistance to attack and mass transfer with composition were investigated for non-isothermal systems with particular reference to chromium content. For pure bismuth higher chromium content of otherwise low-alloy steels increases resistance to attack by the liquid metal at temperatures up to 550°C. Of the series of steels tested, the one containing 12% Cr proved to be the most resistant to attack and mass transfer, no indication of this occurrence being observed during 2500 hours of continuous testing. (auth)

14031
FORMATION OF BERYLLIUM CARBIDE DURING THE CORROSION OF BERYLLIUM IN CARBON MONOXIDE AND IN CARBON DIOXIDE GAS. V. D. Scott (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nature 186, 466-7(1960) May 7.

Reflection electron diffraction patterns showed that beryllium carbide is formed together with beryllium oxide during the reaction at 700°C of beryllium with static carbon monoxide gas and also with static carbon dioxide gas and that carbon particles are dispersed within the oxide layer. Thermodynamical results indicate that free carbon could also be formed during the reactions. (C.H.)

14032
OXIDATION OF BERYLLIUM IN CARBON DIOXIDE AND IN CARBON MONOXIDE. S. J. Gregg, R. J. Hussey, and W. B. Jepson (The University, Exeter, Eng.). Nature 186, 468-9(1960) May 7.

The oxidative behavior of beryllium at temperatures in the range 500 to 750°C in carbon dioxide, carbon monoxide, and mixtures of these two gases was investigated with the aid of a tracer technique using C^{14} labeled carbon dioxide. Results are presented graphically. (C.H.)

14033
TIME-TEMPERATURE PARAMETERS AFFECTING CORROSION OF 18Cr–8Ni WELD METALS. Thomas J. Moore (Arcos Corp., Philadelphia). Welding J. (N. Y.) 39, 199s-204s(1960) May.

Boiling nitric acid corrosion tests were conducted on 0.026, 0.036, 0.047, and 0.067% carbon 18Cr–8Ni weld metals which were deposited using covered electrodes. All-weldmetal specimens were aged at 800 to 1300°F for 0.1 to 10,000 hr prior to corrosion testing. It was found that the time-temperature-corrosion rate relationship follows a definite pattern which can be presented in the form of a three-dimensional drawing, or as a "contour map" time-temperature-sensitization diagram. Long times at low temperatures (800 to 1100°F) were found to sensitize the weld metals to a marked degree, much more severely than conventional sensitizing heat treatments of 1200°F for 1 or 2 hr. The corrosion rate was found to decrease with decreasing carbon content, although even the 0.026% carbon weld metal exhibited severe sensitization after low temperature (800 to 1100°F) aging. A stabilizing heat treatment of 1200°F for 12 hr prior to 1000°F aging showed promise in maintaining acceptable corrosion resistance for the 0.036% carbon weld metal. However, stabilizing heat treatments prior to 800 to 900°F aging did not appear to be effective in reducing the excessive corrosion rates after long-time aging periods. (auth)

14034
CORROSION OF REFRACTORIES BY LIQUID SLAGS AND GLASSES. A. R. Cooper, Jr. and W. D. Kingery. p.85-92 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Corrosion mechanisms are affected by both physical and chemical properties of the refractory and the liquid slag or glass. Corrosion may take place by a solution process at the surface or by a penetration of liquid into solid grains, grain boundaries, or pores. The limitations concerning the evaluation of corrosion of refractories are discussed on an experimental basis. Sufficient information is available to support the conclusion that the appropriate values for refractory-slag systems fall well outside those generally encountered in convection heat-transfer or diffusion-transfer experiments. A comparison is made of a model system (NaCl, glycerine—water) with a high-temperature system (sapphire, $CaO-Al_2O_3-SiO_2$ slag) for the maximum and minimum values of the Grashof, Reynolds, and Schmidt Numbers. It is shown that the dimensionless qualities of the model system completely encompass those of the actual system, affirming the suitability of the chosen model. (B.O.G.)

Fabrication

14035 CNLM-1802-11
Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.
VACUUM ARC MELTING. A Bibliography. E. A. Cernak, J. Doyle, and S. Aconsky, comps. Mar. 16, 1960. 72p.

A bibliography, containing 334 references, from papers published from 1945 to 1959 is presented on the consumable- and nonconsumable-electrode vacuum arc melting process. Electrode preparation, furnace construction and operation, melting, sintering, vacuum techniques, and theory are considered. (C.J.G.)

14036 HW-62821
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FABRICATION OF ALUMINUM—1.8 w/o PLUTONIUM PCTR LOADING. J. B. Burnham. Nov. 11, 1959. 22p. Contract AT(45-1)-1350. OTS.

Fabrication of fuel rods of five different types for the low exposure PCTR loading is described. The cores were a cast Al—1.8 wt.% Pu alloy extruded and cut to length. These were slipped into Zircaloy-2 cans, the second end caps welded, leak tested, and then etched. Forty monitor foils were also fabricated. These consisted of 10-mil disks of the Pu—Al alloy clad on both sides with five mils of Al. The composite was cold welded in a press and die. (auth)

14037 LS-65
Israel. Atomic Energy Commission, Tel Aviv.
LITERATURE SURVEY ON ELECTROLESS NICKEL PLATING. Aug. 1959. 7p.

A bibliography is presented on electroless Ni plating. The references were collected from Nuclear Science Abstracts Vols. 4-12 (1950-58) and Vol. 9, Nos. 1-10, Chemical Abstracts Vols. 50-52 (1956-58) and Vol. 53, Nos. 1-11, and Metallurgical Abstracts Vols. 19-25, Sept. 1951—Aug. 1958 up to July 1959. 63 references. (T.R.H.)

14038 NAA-SR-Memo-4140
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
INVESTIGATION OF VAPOR PHASE PLATING FOR CLADDING REACTOR FUELS: LITERATURE SEARCH. J. Bodine. July 14, 1959. 14p. OTS.

The use of vapor phase plating as a method of cladding U—10 Mo and other reactor fuels with Mo and Cr is investigated. (W.L.H.)

14039 NP-8626
Brush Beryllium Co., Cleveland.
FUSION WELDING OF BERYLLIUM. Technical Report No. 161. Progress Report No. 2 [for] August 1 to October 31, 1959. B. M. MacPherson and W. W. Beaver. Nov. 1959. 21p. Project No. 7351. Contract AF33(616)-6413.

Standard welding conditions for the fusion welding of beryllium, based on ⅛-inch QMV beryllium sheet, are reported. Weld tests were made using drawn beryllium wire coated with copper, silver, gold, nickel, iron, cobalt, tin, and chromium. In addition to the grain-growth problem, excess welding amperage was found to be the major cause of weld porosity and cracking. (For preceding period see NP-7901.) (auth)

14040 NYO-2572
Aeroprojects, Inc., West Chester, Penna.
APPLICATIONS OF ULTRASONIC ENERGY. Task No. 1: CHEMICAL PROCESSING. Task No. 2: METAL AND CERAMIC POWDER PROCESSING. Progress Report No. 18 Covering Period from October 1, 1959 to November 30, 1959. Dec. 1959. 38p. Contract AT(30-1)-1836. OTS.

The dissolution of uranium slugs in molten cadmium was conducted in the high-temperature inert atmosphere ultrasonic treatment furnace. Analysis of the cadmium melt disclosed equilibrium concentrations (2.27 wt. %) of uranium present after 2-hour ultrasonic treatment at 525°C in contrast to 0.03 wt. % uranium for a 2-hour non-ultrasonic control. In metal and ceramic powder processing, ultrasonic activation of the extrusion die resulted in substantial improvements in the extrusion process. Experiments with duplicate batches of the same alumina formulation demonstrate that under ultrasonic treatment extrusion is readily effected near the maximum travel rate of the piston at a pre-set press load, whereas without ultrasonics no extrusion is obtained. For certain water concentrations the load requirement can be reduced to 1/8th of the force necessary without ultrasonics. Flow rate of alumina and clay slips through a 0.050-in. ID orifice under ultrasonic treatment increased as much as 300% over the flow rate without ultrasonics. Thus, ultrasonic flow promotion appears feasible for casting pin- and plate-type elements. (auth)

14041 ORO-267
Carborundum Co., Niagara Falls, N. Y.
SYNTHESIS AND FABRICATION OF REFRACTORY URANIUM COMPOUNDS. Monthly Progress Report No. 7 [for] March 1 through March 31, 1960. K. M. Taylor, C. A. Lenie, P. E. Doherty, L. N. Hailey, and T. J. Keaty. Apr. 12, 1960. 4p. Contract AT(40-1)-2558. OTS.

The UN pellets to be sintered were placed in a tantalum container which was sealed in a plastic bag. The bag and contents were placed in an inert atmosphere at 1800°C. No improvement in density was obtained over the previously reported 91 to 93% of theoretical. In the preparation of UC from ammonium diuranate and C, good results were obtained by the addition of the theoretical amount of C needed to react with the UO_2 formed by the decomposition of ammonium diuranate. The effects of variation in furnacing on the product are discussed. Experiments on the fabrication of UC from hot-pressing U metal powder and C revealed insufficient intimate mixing. Pellets of U_3Si_2 of 93% theoretical density were fabricated by cold-pressing and sintering. X-ray-diffraction analysis indicated some pick-up of oxygen. (See also ORO-254.) (C.J.G.)

14042
FORCE AND DEFORMATION ASPECTS OF PRESSURE-WORKING APPLIED TO URANIUM. I. L. Perlin, I. D. Nikitin, V. A. Fedorchenko, A. D. Nikulin, and N. G. Reshetnikov. Atomnaya Energ. 8, 219-27(1960) Mar. (In Russian)

Temperature dependence, mean specific pressure on the rollers, and absolute expansion as functions of reduction (10 to 50%) and temperature (400 to 1000°C) are analyzed. The compression stresses in drawing at temperatures from 250 to 800°C and a scale factor of 5 are studied. Formulas for compression and stress are derived, and the drawing stress and reserve factor dependence on deformation from 5.5 to 34% was determined. (tr-auth)

14043
ELECTRON UNIT SOLVES PROBLEM OF WELDING REFRACTORY METALS. A. Adelhardt and R. H. Witt (Republic Aviation Corp., Farmingdale, N. Y.). Iron Age 185, No. 17, 108-10(1960) Apr. 28.

An electron beam welder is described which is used in welding refractory metals. This welder produces welds in molybdenum, niobium, and tungsten which can be flexed without cracking due to small crystal formation on the cooling. The welder operates at a 30-kv peak, 130 cal potential heat input, and at welding speeds of 0 to 20 ipm (linear) or 0 to 6.4 rpm (circumferential). (B.O.G.)

14044
PRECISION COLD EXTRUSION OF METALS. R. A. Quadt (Bridgeport Brass Co., Conn.). Metal Progr. 77, No. 5, 121-4; 164(1960) May.

Precision cold extrusion is advantageous in metal fabrication because of its economy, absence of metal—gas reactions and recrystallization, and precise dimensional control. Lubrication remains a problem, however. Properties (strength, etc.) that may be expected of extruded aluminum alloys and unalloyed titanium are given. Changes in the properties of reactor-grade zirconium upon being cold extruded (reduced 80%) are also given; important advantages of cold extrusion for zirconium are recovery up to 85% of the billet weight and no cladding required. Large pieces of steel can be cold extruded, as for rocket motors. Current development work on titanium and molybdenum alloys was unsuccessful because of tool breakage. Thin-walled niobium and tantalum tubes have been drawn and appear to answer the requirements of nuclear power plants. Tube blanks have been drawn from vanadium and beryllium. (D.L.C.)

14045
TRACER FOLLOWS LEVELER IN ELECTROPLATING BATH. Seward E. Beacom and Bernard J. Riley (General Motors Research Labs., Warren, Mich.). Nucleonics 18, No. 5, 82-4(1960) May.

A tracer shows how some additives reverse normal electrodeposition. The tracer in electroplating causes more metal to be deposited in valleys by acting as an insulator and diverting the plating current to the valleys. The additive, S^{35}-labeled sodium allyl sulfonate, was prepared from the reaction of sodium sulfite and allyl bromide and introduced into a Watts-type nickel plating bath. The electrodeposits were studied by counting and radioautography. Recorded results as well as these confirm the assumption that to initiate leveling, the addition agent first must be concentrated preferentially on the peaks. The mechanism of this concentration action has not yet been demonstrated satisfactorily. (B.O.G.)

14046
ULTRASONIC WELDING AND IMPROVED STRUCTURAL EFFICIENCY. J. Byron Jones and Harold L. McKaig (Aeroprojects, Inc., West Chester, Penna.). IAS Paper No. 60-10. Presented at the IAS 28th Annual Meeting, New York, New York, January 25-27, 1960. New York, Institute of the Aeronautical Sciences, 1960. 21p. $1.00.

Ultrasonic welding systems are described, and the mechanism of ultrasonic welding is discussed. Metallurgical properties, weld strength, reproducibility, structural design, leak tightness, fatigue strength, and strength degradation of ultrasonic welds are discussed. (C.J.G.)

14047
NUCLEATION AND NUCLEI GROWTH IN SINTERED ALUMINA. I. B. Cutler. p.120-7 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

The theory of nucleation and nuclei growth is discussed with particular interest given to sintered aluminum oxide powders. Additions of other oxides to alumina can greatly affect the sintered grain size. The oxide additives have been classified as those that: increase grain growth, such as titanium, manganese, niobium, and germanium; have little or no effect; and retard grain growth, of which magnesia is the most notable. Micrographs are given for manganese content to 4.77% at firing temperatures of 1600 to 1835°C. The rate of grain growth is given for alumina compared to alumina with 2% additions of TiO_2 and MnO fired at 1450°C. It was concluded that the rate of nuclei growth is exponentially dependent upon the firing temperature. (B.O.G.)

14048
SINTERING MECHANISMS OF ALUMINUM OXIDE. G. C. Kuczynski, L. Abernethy, and J. Allan. p.163-72 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Experiments on the sintering of single-crystal Al_2O_3 spheres to each other and to flat plates seem to indicate that the process is one of volume diffusion, regardless of the sintering atmosphere. Sintering occurred faster in dry hydrogen than in the other atmospheres. Even after transformation of the spheres into polyhedra, by heating them for a long time in dry hydrogen, the sintering mechanism seems still to be predominantly volume diffusion. In the presence of impurities, such as tungsten or molybdenum oxides, the sintering mechanism was found to be that of viscous flow. (B.O.G.)

Properties and Structure

14049 ARDC-TR-59-66
Syracuse Univ., N. Y. Research Inst.
AIR WEAPONS MATERIALS APPLICATION HANDBOOK:

METALS AND ALLOYS. First Edition. G. Sachs, ed. Dec. 1959. 541p. Contract AF18(600)-1794.

Current data on the properties of metals and alloys of primary importance in production and design of air weapons are presented. General discussions on alloys and detailed data on alloy properties are included. (J.R.D.)

14050 BM-RI-5604
Bureau of Mines.
PROPERTIES OF TITANIUM–VANADIUM–ZIRCONIUM ALLOYS. Jack D. Ramsdell and Ernest D. Hull. May 1959. 15p.

Arc-melted Ti–V–Zr alloys ranging in composition from 5 to 20 at.% V and 5 to 30 at.% Zr were investigated relative to hardness, hot workability, and room-temperature tensile properties. Structural changes and aging response to test temperatures of 600 and 800°C were studied. A Ti–10V–10 Zr alloy solution treated at 600°C exhibited a yield strength of 73,800 psi. Aging the alloy for four hours at 450°C increased the yield strength to 142,900 psi. (C.J.G.)

14051 CEND-84
Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.
THE DEVELOPMENT AND TESTING OF HOMOGENEOUS CERAMIC FUELS. Progress Report for Period December 1, 1959–February 29, 1960. G. Zuromsky. 36p. Contract AT(30-1)-2379, Task III. (NYO-2990). OTS.

Results of x-ray diffraction and microscopic evaluations of UO_2–CaO–ZrO_2 compositions sintered in vacuum at 1500 to 1900°C are discussed. A continuous series of face-centered cubic solutions was found at 1700°C and higher. $CaZrO_3$ is present as a second phase in all compositions containing 15 and 20 wt.% CaO and in low UO_2 compositions. Changes of sintering atmosphere, involving the use of air, argon, or vacuum, and changes in the cooling rate after sintering had no effect on the "d" spacings for various compositions in the system. Data on density, shrinkage, weight change, and structures are included on specimens in the UO_2–ZrO_2–CaO series which were sintered at 1800°C to produce face-centered cubic solid solutions, and isothermally heated at 1000°C in air for 28 days. Structures in the UO_2–CeO_2 system were also investigated by sintering in air, argon, and vacuum. (For preceding period see NYO-2742.) (J.R.D.)

14052 CF-59-8-62
Oak Ridge National Lab., Tenn.
SURFACE-EXCHANGE METHOD FOR DETERMINATION OF SURFACE AREA OF UO_2 POWDER. R. L. Ferguson and G. W. Leddicotte. Aug. 6, 1959. 12p. OTS.

The applicability of the surface-exchange method to the determination of heterogeneous isotopic exchange between uranium atoms in UO_2 particles was investigated. Preliminary results indicate that the method offers a rapid and easy determination of surface area with a precision of ~10%. (auth)

14053 CWR-498
Curtiss-Wright Corp. Research Div., Quehanna, Penna.
REPRODUCIBILITY OF THE MECHANICAL PROPERTIES OF CERAMIC MATERIALS. EFFECT OF METHOD AND RATE OF LOADING ON THE MODULUS OF RUPTURE OF ALUMINUM OXIDE. O. W. Thomas and N. R. Wheelock. Jan. 6, 1958. 46p. Contract AF33(616)-3831.

The reproducibility of mechanical properties was examined relative to the effect of the method and rate of loading on the modulus of rupture of sintered alumina formed by extrusion. The modulus of rupture was found to be in statistical control, both single-point and quarter-point loaded test results being described closely by the normal distribution. The modulus of rupture varied with changes in the rate of load application and was slightly higher when minor surface defects on the specimens were not subjected to tensile stress. Reproducibility was apparently the same under all test conditions. The single-point modulus of rupture, when corrected for the effects of concentrated load, was almost identical with the modulus determined by quarter-point loading. There was apparently no advantage in testing by the more complex quarter-point loading method. (auth)

14054 DMIC-125
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF COLUMBIUM AND COLUMBIUM-BASE ALLOYS. E. S. Bartlett and J. A. Houck. Feb. 22, 1960. 66p. Contract AF18(600)-1375. (PB-151082). OTS.

Niobium is inherently a soft, ductile, readily fabricable material. Although its melting temperature is about 4380°F, pure niobium becomes too weak for structural use at temperatures above about 1200°F. Niobium is a very reactive metal, in that it dissolves large quantities of oxygen and probably nitrogen on exposure to atmospheres containing even small amounts of these elements at modest temperatures. The technology of niobium and its alloys is affected accordingly. The alloys of niobium are strengthened by dispersion-hardening and/or solid-solution mechanisms. Molybdenum, tungsten, and vanadium are characteristically employed as solid-solution strengtheners, whereas zirconium forms dispersions by reacting with oxygen or carbon present in the base material as a residual impurity or as an intentional addition. Solid-solution additives affect strength at low temperatures as well as at elevated temperatures. Dispersion-forming additives are most effective in maintaining strength in high-temperature, time-dependent, creep applications, exerting relatively little effect at lower temperatures. Both types of additives may effectively increase recrystallization and ductile : brittle transition temperatures, and very likely result in loss of toughness at low temperatures. Titanium and tantalum do not increase the strength of niobium appreciably but improve its oxidation resistance, or, in the case of tantalum, raise its recrystallization temperature. Data on seven currently commercial or pilot-production alloys are presented. Of these, the Cb–15W–5Mo–1Zr–0.05C–0.050 composition appears to be the most promising for elevated-temperature structural applications, based on strength and recrystallization temperatures. This alloy has a 100-hour rupture stress of 35,000 psi at 2000°F, or 17,000 psi at 2200°F. (auth)

14055 DMIC-127
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF TUNGSTEN AND TUNGSTEN-BASE ALLOYS. V. D. Barth. Mar. 15, 1960. 62p. Contract AF18(600)-1375. (PB-151084). OTS.

A review is presented of the physical and mechanical properties of tungsten and tungsten-base alloys. Tensile properties of tungsten up to the melting point were measured. In evaluating the mechanical properties, the effects of the ductile-brittle transition and of recrystallization were taken into account. (C.J.G.)

14056 DMIC-Memo-52
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
REVIEW OF PROBLEMS IN USING FLAT-ROLLED

MATERIALS IN AIR- AND SPACE-WEAPON SYSTEMS. Apr. 14, 1960. 20p. (PB-161202). OTS.

The problems of producing and using sheet materials intended for service at high temperatures are reviewed. (W.L.H.)

14057 HW-63081

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SINTERING STUDIES ON THE SYSTEM UO_2-PuO_2. II. SINTERABILITY. T. D. Chikalla. Dec. 17, 1959. 35p. Contract AT(45-1)-1350. OTS.

Sinterability, as defined by final sintered density, was investigated for the system UO_2-PuO_2 as a function of time, temperature, and type of PuO_2 addition. Uranium dioxide containing UO_2-PuO_2 solid solution type additions results in greater densification rates than does UO_2 containing UO_2-PuO_2 physical mixture type additions. Solid solutions formed by sintering, when ground and re-sintered, also densify more rapidly than do two phase mixtures. A mechanism explaining these differences in rates is proposed. X-ray diffraction data indicates that homogeneous single phase formation is virtually complete after eight hours at 1500°C or one hour at 1600°C. No reduction of plutonium dioxide to a sub oxide during heating in hydrogen was observed. (auth)

14058 KAPL-2072

Knolls Atomic Power Lab., Schenectady, N. Y.

INTERNAL-PRESSURE CREEP-RUPTURE TESTS OF ZIRCALOY-2 TUBING. G. J. Sokol and D. T. Groleau. Jan. 22, 1960. 20p. Contract W-31-109-Eng-52. OTS.

Stress-rupture tests were performed on unirradiated Zircaloy-2 at room temperature, 600, and 700°F. The results indicated that the ductility, defined as effective strain, is not significantly affected by time to rupture. At 600°F, the ductility was considerably greater than at room temperature or at 700°F. Depending on the conditions of test, the ductility values range from 16 to 77%. (auth)

14059 LA-2402

Los Alamos Scientific Lab., N. Mex.

THERMODYNAMIC PROPERTIES OF REFRACTORY BORIDES. PART I. EVAPORATION BEHAVIOR AND VAPOR PRESSURE OF ZIRCONIUM DIBORIDE. PART II. PHASE STUDIES IN THE TANTALUM-BORON SYSTEM BETWEEN Ta AND TaB. James M. Leitnaker. Jan. 1960. 266p. Contract W-7405-eng-36. OTS.

Vapor pressures of zirconium over zirconium diboride in a tungsten crucible were measured over the temperature range 2150 to 2475°K. Reaction of the solid boride with residual gases in the system producing volatile oxides was investigated and measured pressures were corrected for the increased volatility. Several different orifice sizes were used and the data therefrom used to obtain an evaporation coefficient of 0.025 ± 0.010. Zirconium diboride is believed to vaporize according to the equation $ZrB_{1.906}$ (s) = Zr (g) + 1.906 B (g) with a Third Law ΔH_0° of 458.3 ± 6.5 kcal/mole and an associated entropy change of 98.4 ± 3.0 eu. The inconsistency between the observed value and the calculated value of 477.4 kcal/mole can be explained on the basis of inconsistencies in the heat of vaporization of metallic zirconium. Phase studies of the solid portion of the Ta-B system were made between Ta and TaB. Two intermediate phases were found: $Ta_{2.4}B$ (referred to as Ta_2B in the literature) and Ta_3B_2. Both have narrow ranges of homogeneity. $Ta_{2.4}B$ is stable only at high temperatures, decomposing at 2040 ± 30°C to Ta and Ta_3B_2. Ta_3B_2 is the low-temperature stable phase, decomposing above 2180 ± 20°C to $Ta_{2.4}B$ and TaB. Rates of reactions of the elements and of intermediate phases were investigated; these rates are believed responsible for errors in the work of previous investigators. (auth)

14060 NACA-RM-L-58E22

Langley Aeronautical Lab., Langley Field, Va.

QUALITATIVE MEASUREMENTS OF THE EFFECTIVE HEATS OF ABLATION OF SEVERAL MATERIALS IN SUPERSONIC AIR JETS AT STAGNATION TEMPERATURES UP TO 11,000°F. Bernard Rashis, William G. Witte, and Russell N. Hopko. July 7, 1958. Decl. Dec. 1, 1959. 26p.

The ablation rates and effective heats of ablation were determined for a number of materials in supersonic ceramic-heated and electric-arc-powered air jets at stagnation temperatures ranging from 2,000 to 11,000°F. The results indicated that the effective heats of ablation were from 7 to 40 times greater than the heat-absorption capacity of copper and increased with increasing aerodynamic heat flux. In addition, the results indicated that for the materials having phenolic-resin binders, the effective heats of ablation decreased with increasing resin content. (auth)

14061 NDA-44(Del.)

Nuclear Development Corp. of America, White Plains, N. Y.

DETERMINATION OF THE SOLUTION RATE OF METALS IN LITHIUM. Bertram Minushkin. June 30, 1958. Decl. with deletions Nov. 10, 1958. 40p. OTS.

A method for measuring the rate at which metals dissolve in liquid lithium under controlled non-equilibrium conditions is described. Solution rates of nickel-bearing stainless steel in lithium at 1600°C was 3.0 $mg/in.^2$-hr until depletion of the nickel where the solution rate decreased to 0.3 $mg/in.^2$-hr. It is shown that this solution rate accounts for mass transfer rates observed in thermal convection loop tests. Solution rate tests confirmed the deleterious effects of nitrogen and oxygen and the beneficial effects of aluminum additions on mass transfer rates observed in thermal convection loop tests. (C.J.G.)

14062 NMI-1227

Nuclear Metals, Inc., Concord, Mass.

STRESS-RUPTURE PROPERTIES OF BERYLLIUM CONTAINING CARBIDE AND OXIDE DISPERSIONS. J. Greenspan. Mar. 23, 1960. 23p. Contract AT(30-1)-1565. OTS.

Dispersion-strengthened systems of beryllium containing beryllium oxide or beryllium carbide were formed and the stress-rupture properties determined at 1200, 1350, and 1500°F. Creep deformation of both systems was studied. (C.J.G.)

14063 NP-8585

University of Southern California, Los Angeles.

CARBIDES AND NITRIDES OF THE RARE-EARTH METALS. PARTS I AND II. Final Report. James C. Warf and Gus J. Palenik. Mar. 18, 1960. 115p. Project No. 683. Contract DA-04-495-Ord-421.

The carbides of some of the rare earths, La, Ce, Pr, and Nd, were studied using x-ray diffraction, mass spectrometry, and gas chromatography. The electrical conductivity of CeC_2 powder was also measured and found to be on the same order of magnitude as that of copper powder. The structure of the dicarbides (MC_2) and the sesquicarbides (M_2C_3) is given along with their cell constants. A possible theory to account for the metallic properties of the dicarbides is given. No monocarbides (MC) or tricarbides (MC_3) were observed. The results of hydrolysis studies are discussed, and a mechanism for hydrolysis of the dicarbides is postulated from the fact that nearly equal amounts of cis and trans 2-butene forms in the reaction. Comparisons are made between the crystal structure and hydrolytic behavior of the rare earth carbides and those of Ca, U, and Th. Possible future studies of the carbides are suggested. (D.L.C.)

14064 NP-8593
Buffalo. Univ.
PROGRESS REPORT NO. 9 [FOR] JANUARY 1, 1960 TO MARCH 31, 1960. J. F. Andrew, N. Juul, H. E. Strauss, and S. Mrozowski. Apr. 13, 1960. 27p. Contract AF33(616)-5186.

Results of further determinations of the Poisson ratio for graphite rods are reported, and the data for Young's modulus and permanent set determinations as a function of heat-treatment temperature for two special series of rods made with graphitized filler (soft and hard) and soft binder are presented. A calibration procedure used with the high-temperature elasticity equipment and the details of improved high-temperature equipment for determination of heat conductivity are described. A discussion of the discrepancy of results between calculated heat diffusivity coefficients and values determined from experimental data is also included. (For preceding period see NP-8280.) (J.R.D.)

14065 R58CAP25
Canadian General Electric Co., Ltd. Civilian Atomic Power Dept., Peterborough, Ont.
A REVIEW OF THE PROPERTIES OF MATERIALS FOR ORGANIC COOLED REACTOR COOLANT TUBES. D. G. Boxall and A. R. Daniel. Aug. 25, 1958. 91p.

A review of the neutron absorption, corrosion resistance, irradiation damage, and mechanical properties of Be, Al—Fe alloys, steels, and Al, Mg, and Zr alloys for use in organic-cooled reactor coolant tubes is presented. (C.J.G.)

14066 TID-5754
California. Univ., Berkeley. Minerals Research Lab.
FUNDAMENTALS OF GLASS-TO-METAL BONDING. VIII. WETTABILITY OF IRON BY MOLTEN SODIUM DISILICATE. Technical Progress Report No. 8. Robert W. Cline, Richard M. Fulrath, and Joseph A. Pask. Mar. 1, 1960. 30p. Project No. 7. Contract AT(11-1)-34. OTS.

An experimental unit was developed to allow the application of the glass specimen onto the metal surface at elevated temperatures under controlled atmospheric conditions at low pressures. The contact angle of sodium disilicate glass on platinum served as a check on the atmosphere. Sodium disilicate glass on Armco iron has a contact angle of 55 ±2° at 900 to 1000°C in vacuum and poor adherence: on magnetite, 2 ±1° and excellent adherence. Behavior on oxidized iron was affected by the ability of the glass to rapidly dissolve large quantities of the oxide. Glass when dropped onto a lightly oxidized surface spread toward lower angles and retracted to the 55° angle upon solution of the oxide; adherence, in this case, correspondingly ranged from good to poor. When the glass dissolved a sufficient amount of iron oxide to cause crystallization of fayalite, the contact angle was in the range of 15 to 35°, the best adherence was obtained, and etching of the metal at the interface occurred. Vaporization of iron in vacuum at 1000°C did not seem to be retarded by thin oxide films. Presence of zirconium foil in the evacuated system tended to reduce grain growth of the iron. (auth)

14067 TID-5832
Metal Hydrides Inc. Chemical Research Lab., Beverly, Mass.
LETTER REPORT NO. 13. David W. Rudd. May 6, 1960. 7p. Contract AT(30-3)-2298. OTS.

Data on the permeation of hydrogen through nickel at temperatures of 640 to 800°C and pressures of 1.1 to 2.0 atm. are given. (C.J.G.)

14068 WADC-TR-58-432(Pt.II)
Firth Sterling, Inc. American Electro Metal Div., Yonkers, N. Y.
AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF CERMETS AS RELATED TO THE MICROSTRUCTURE. [Period] covered May 15, 1958 to June 1, 1959. Ira Binder. Aug. 1959. 101p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5084. OTS.

TiC/Ni compositions with 10, 20, and 40 percent nickel were tested for transverse rupture strengths up to 1600°C. Transverse bend, cantilever beam, hot deformation, and hot extrusion experiments were performed in order to study the onset of plastic deformation. These materials were plastically deformed, and their microstructures were studied to learn about the mode of deformation, plastic flow of the nickel binder, and alignment of the carbide grains. Other refractory hardmetal compositions, both single phase and cemented, were tested in transverse rupture up to 1600°C and were also subjected to various forms of hot deformation. Transverse strength peaks, versus temperature, were found for each material in the range 800 to 1300°C. Reasons for this behavior are developed. Microstructures of these materials were examined in connection with the strength tests and deformation studies. (auth)

14069 WADC-TR-59-276(Pt.I)
National Bureau of Standards, Washington, D. C.
THERMAL DIFFUSIVITY OF IRON. PART I. A GENERATOR FOR PRODUCING SINUSOIDAL TEMPERATURES. [Period covered]: January 1, 1957 to July 31, 1958. Howard W. Flieger, Jr. and Defoe C. Ginnings. July 7, 1959. 12p. Project title: ICBM MATERIALS. Task title: THERMAL DIFFUSIVITY OF IRON. Contract AF33(616)-57-6. OTS.

Using sine potentiometers, sinusoidal temperature waves were obtained with distortions comparable with the inaccuracies of the sine potentiometers. The system using pulse time modulation has the advantages that (1) a simple relay is used to turn on and off a fixed current to give a sinusoidal power variation in an electric heater, (2) and additional fixed power can be added to the sinusoidal power without producing distortion, and (3) the generator can be used easily with servocontrol either to improve wave form or to introduce known distortion. (auth)

14070 WADC-TR-59-448
Stanford Research Inst., Menlo Park, Calif.
MECHANICAL PROPERTY SURVEY OF REFRACTORY NONMETALLIC CRYSTALLINE MATERIALS AND INTERMETALLIC COMPOUNDS. [Period] covered: June 15, 1958 to June 15, 1959. William D. Smiley, Leon E. Sobon, Frank M. Hruz, Eldon P. Farley, J. Emery Chilton, Eugene F. Poncelet, and John J. Kelly. Aug. 1959. 318p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: MECHANISMS OF FLOW AND FRACTURE OF METALLIC AND NONMETALLIC CRYSTALLINE SUBSTANCES. Contract AF33(616)-5907.

The literature on the mechanical properties of nonmetallic polycrystalline compounds and intermetallic compounds with melting points above 1500°C was surveyed. The theoretical concepts of flow and fracture were reviewed. It was determined that the mechanical properties of many potential high temperature materials have not been evaluated. It was concluded that the intermetallic compounds which are brittle at room temperature and slightly ductile at high temperature (where some of them are also stronger) are more worthy of future study than the much worked-over oxides and interstitial compounds. Another conclusion of this study was that conventional parameters, such as tensile strength, etc., may not be of value for designing high temperature structural components, and that data from tests closely simulating actual use conditions are necessary before the designer can confidently use brittle materials. (auth)

14071 WADD-TR-59-26

Wright Air Development Div. Materials Lab., Wright-Patterson AFB, Ohio.

AN INVESTIGATION OF THE RELATIONSHIP OF HOT-HARDNESS TO THE ELEVATED TEMPERATURE EXTRUSION BEHAVIOR OF SELECTED ARC-CAST MOLYBDENUM BASE ALLOYS. [Period covered] January 1, 1959 to November 1, 1959. John Robert Giancola. Feb. 10, 1960. 132p. Project title: METALLIC MATERIALS. Task title: REFRACTORY METALS. OTS.

A study was conducted to determine the relationship between the hot hardness and the required extrusion forces and percent yield of sound material for molybdenum and molybdenum-base alloys. The extrusion force was measured while the controllable variables were held constant. It was found that no definite relationship between hot hardness and the extrusion forces or yield of wound metal could be established. Extrusion and hot hardness data are presented for an alloyed Mo, Mo–Ti, and Mo–Ti–Zr alloys along with apparent relationships between the extrusion temperature and both the average extrusion force and the percent yield. (auth)

14072 JPRS-2541

MEASURING THE MELTING POINTS OF ALUMINUM AND COPPER AT PRESSURES UP TO 18,000 KILOGRAMS PER CENTIMETER. M. G. Gonikberg, G. P. Shakhovskoi (Shakhovskoy), and V. P. Butuzov. Translated from Zhur. Fiz. Khim. 31, 839-42(1957). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 318.

14073

THE CRYSTAL STRUCTURES OF SOME PLUTONIUM BORIDES. B. J. McDonald and W. I. Stuart (United Kingdom Atomic Energy Authority, Sellafield, Eng.). Acta Cryst. 13, 447-8(1960) May. (In English)

X-ray-powder photographic studies of the plutonium-boron system revealed four plutonium borides, PuB, PuB_2, PuB_4, and PuB_6, and several other unidentified phases. The samples were prepared by heating powdered mixtures at 800°C in the range 60 to 65 at.% boron and at 1200°C in the range 40 to 95 at.% boron. PuB_2 formed at 800°C in the composition range studied, while the others formed at 1200°C. PuB, PuB_4, and PuB_6 formed in the composition ranges 40 to 70, 70 to 85, and >70 at.% boron, respectively. The crystal structure (lattice parameters, interatomic distances, etc.) of these borides are given. (D.L.C.)

14074

OBSERVATIONS ON THE SYSTEMS Th–S, Th–Se, AND Th–Te. J. Graham and F. K. McTaggart (Commonwealth Scientific and Industrial Research Organization, Melbourne). Australian J. Chem. 13, 67-73(1960) Feb.

An investigation of these systems by x-ray diffraction shows the marked effect of the purity of materials on the phases formed. New polychalcogenides ($ThS_{2.5}$ and $ThSe_{2.5}$ having tetragonal symmetry, and $ThTe_3$ monoclinic), and a sesquitelluride (Th_2Te_3, with hexagonal symmetry), probably non-stoichiometric, were found. Discrepancies between the present results and those of previous workers are discussed. (auth)

14075

STUDY OF THE PRECIPITATION OF TRACE IMPURITIES IN BERYLLIUM. Pierre Pointu, Lucien Espagno, Pierre Azou, and Paul Bastien (École Centrale des Arts et Manufactures, Paris). Compt. rend. 250, 2365-7 (1960) Mar. 28. (In French)

The precipitation of trace impurities (especially the transition elements) in beryllium was studied by radiocrystallography, resistivity measurements, micrography, and electron microprobe. One precipitate studied has an orientation relationship with the matrix. (tr-auth)

14076

EFFECTS OF FLUCTUATIONS OF CORRELATION PARAMETERS ON THE X RAY AND THERMAL NEUTRON SCATTERING BY SOLID SOLUTIONS. M. A. Krivoglaz (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Fiz. Metal. i Metalloved. 8, 648-66(1959) Nov. (In Russian)

X-ray and neutron scattering by solid solution replacements caused by variable atomic scattering factors and geometric distortions is studied. Heterogeneities in composition and correlation parameter fluctuations are analyzed. Considerations of correlation parameter fluctuations lead to considerable changes in isodiffusion curves. Ideal solutions and solutions near the second-order phase transition point are investigated. Formulas were derived for correct reflections weakened by distortions. (R.V.J.)

14077

TEXTURE DEFORMATION AND RECRYSTALLIZATION OF Fe–Ni (48% Ni) IN COLD ROLLING. M. M. Borodkina and N. P. Gromov (Central Scientific Research Inst. of Ferrous Metallurgy, USSR). Fiz. Metal. i Metalloved. 8, 761-9(1959) Nov. (In Russian)

X-ray studies of thin (50 to 5 μ) cold-rolled strips of Fe–Ni (48%) show that the maximum deformation intensity is reached at ~99.0% orientation at $(110)[1\bar{1}2]$ + $(110)[3\bar{3}5]$, with clear-cut cubic recrystallization (110) [001] texture observed after annealing. An increased deformation leads to transitions from $(110)[1\bar{1}2]$ + (110) $[3\bar{3}5]$ orientations to $(112)[11\bar{1}]$ and to weakening and destruction of recrystallization texture. (tr-auth)

14078

SELECTION, DESIGN, AND USE OF SUPER REFRACTORIES IN HIGH TEMPERATURE OPERATION. Roy W. Brown and Richard F. Nering (Carborundum Co., Perth Amboy, N. J.). Ind. Eng. Chem. 52, 381-4(1960) May.

Considerations in the use of super refractories (silicon carbide, fused alumina, and mullites) in high temperature operation are presented. Tables of the properties and chemical resistance of such refractories are given together with some examples of how they can be applied to industrial problems, which include the use of silicon carbide as reactor container for hydrocarbon pyrolysis at 3000°F and as lining for a hydrogen-chlorine burner. (D.L.C.)

14079

CONSTITUTION DIAGRAMS OF Fe–Cr–Ti AT IRON AND CHROMIUM RICH SIDE OF THE ALLOY. N. G. Boriskina and I. I. Kornilov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 50-8(1960) Jan.-Feb. (In Russian)

Microstructure studies and x-ray-diffraction analysis were made of the Fe–Cr–Ti constitution diagram, and hardness was tested at 1000 and 550°C. Eutectic crystallization was observed in the Ti–Fe region at the $TiFe_2$–Cr cross section of the alloy, and a wide range of alloys was distributed in the right side with higher chromium content. The solubility of Ti in α solid solution increases in the Ti–Fe side at 1000°C and decreases at 550°C. The maximum hardness was found in tempered χ phase alloys. (R.V.J.)

14080

INVESTIGATIONS OF THE QUATERNARY OF Mg–Mn–Ca–Al Alloys. M. E. Drits, M. V. Malt'sev, L. L. Rokhlin, and O. N. Udalova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 59-63(1960) Jan.-Feb. (In Russian)

Isothermal and polythermal cross sections were plotted for the quaternary Al–Ca–Mg–Mn. The data are used for determining the phase composition of the industrial alloy MAG. (R.V.J.)

14081

STRUCTURE AND PROPERTIES OF VANADIUM–TUNGSTEN ALLOYS. V. V. Baron, Yu. V. Efimov, and E. M. Savitskiĭ. Izvest. Akad. Nauk S.S.S.R., Otdel Tekh. Nauk, Met. i Toplivo No. 1, 70-4(1960) Jan.-Feb. (In Russian)

Metallographic, x-ray-diffraction, and thermal analyses and studies of properties were used for plotting vanadium–tungsten alloy constitution diagrams. Vanadium and tungsten form a continuous series of solid solutions. At 4.5 at.% W the solidus and liquidus lines have a clearly expressed minimum at 1635°C; however, no transformation took place in the solution at this point. Small additions of tungsten to vanadium improve plasticity, reduce hardness, and slightly increase stability to compression. Further additions of tungsten alter the characteristic properties of the system. Vanadium interferes with tungsten resistance to oxidation. All the tested V–W alloys and initial metals strongly oxidize at 700 to 1100°C. (R.V.J.)

14082

THERMODYNAMICS OF Co–Ni SOLID SOLUTIONS. De Dyk Man and A. N. Nesmeyanov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 75-84 (1960) Jan.-Feb. (In Russian)

Vapor saturations of cobalt (1070 to 1370°C) and nickel (1050 to 1280°C) and relative and partial cobalt vapor pressures in alloys with nickel were measured. The data were used for calculating the activity, activity coefficients of components, and the thermodynamic functions of alloys. Thermodynamic data are in agreement with solid-state formation of the main bonds and with the formation of cobalt–nickel intermetallic compounds. Correlations were made of the 3d-electron level saturation in alloys and the thermodynamic potential variations. (R.V.J.)

14083

PHASE DIAGRAMS OF Ti–Va–Mo ALLOYS. I. I. Kornilov and R. S. Polyakova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 85-9(1960) Jan.-Feb. (In Russian)

Microstructure analysis of annealed alloys confirmed the limitless diffusion of elements at temperatures exceeding polymorphic titanium transformations. The polymorphic transformation temperature of the alloy reduced with increased molybdenum and vanadium. (R.V.J.)

14084

THERMAL FATIGUE AND WEAR OF METALS. Yu. V. Kostochkin and I. O. Oding. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 1, 101-4(1960) Jan.-Feb. (In Russian)

The influence of cyclic heating and cooling on the wear resistance of nickel–chromium alloy EI-765 and austenitic steel EI-612 used in gas turbine blades was investigated. (R.V.J.)

14085

LOW-TEMPERATURE EQUILIBRIA AMONG ZrO_2, ThO_2, AND UO_2. F. A. Mumpton and Rustum Roy (Pennsylvania State Univ., University Park). J. Am. Ceram. Soc. 43, 234-40(1960) May.

Studies made on low-hafnium-content ZrO_2 show that the monoclinic-tetragonal inversion temperature is 1170°C, and it is raised to approximately 1190°C in the "natural" ZrO_2 which contains approximately 2% HfO_2. No explanation could be found for the known marked hysteresis during cooling, when the reverse polymorphic transformation takes place at 1040°C. In the system ZrO_2–ThO_2 the monoclinic-tetragonal ZrO_2 inversion temperature is lowered to 1000°C, although the maximum solid solution extent of ZrO_2 in ThO_2 and vice versa is approximately only 2% at this temperature. Below about 400°C. under hydrothermal conditions it was possible to prepare a continuous, although metastable, series of solid solutions with the fluorite structure with compositions varying from ThO_2 to nearly pure ZrO_2. Contrary to earlier work only 8 mole % ZrO_2 dissolves in UO_2 and less than 4 mole % of UO_2 in ZrO_2 at temperatures up to 1300°C. A continuous series of solid solutions could be made between ThO_2 and UO_2 at 1300°C, and extensive defect fluorite solid solutions could be prepared between ThO_2 and U_3O_8; there is some evidence for exsolution into uranium-rich and thorium-rich members at low temperatures. (auth)

14086

SOME STUDIES ON THE URANIUM–MOLYBDENUM ALLOY. M. Kawasaki and R. Nagasaki (Atomic Energy Research Inst., Tokyo); M. Itagaki (Mitsubishi Metal Mining Co., Japan); and T. Takemura (Atomic Fuel Corp., Tokyo). J. Atomic Energy Soc. Japan 2, 136-46(1960) Mar. (In Japanese)

U-Mo alloy is of interest as power-reactor fuel. The characteristic behavior of the alloy when subjected to certain heat treatments and its general properties were investigated. The specimens were made by vacuum induction melting and were rolled at 600 and 900°C. In the heat treatment tests, the phase changes by quenching from various high temperature phases, the effects of quenching rate from gamma phase range, and Ms temperature for 1.30% Mo alloy were studied. Thermal cycling test revealed that greater improvement was obtained by gamma quenching followed by alpha annealing for the rolled rods with Mo content ranging from 0.5 to 9.0%. Oxidation test in air at 300, 400, and 500°C had shown that the rate constant of oxidation decreased with increasing Mo contents in the lower Mo range, but it increased as Mo contents became higher. The same tendency was observed on the corrosion test in hot water. The minimum weight loss in 350°C hot water could be obtained at 12 wt. % Mo. (auth)

14087

STUDIES OF NIOBIUM–TANTALUM ALLOYS. H. Braun, K. Sedlatschek, and R. Kieffer (Metallwerk Plansee A. G. Reutte/Tirol, Austria). J. Less-Common Metals 1, 413-19(1959) Dec. (In German)

Sintered and subsequently rolled niobium–tantalum alloys are examined over the whole range of composition. Their hardness, strength, elongation at room temperature, specific electrical conductivity, electrochemical behavior, and corrosion resistance are reported. The mechanical properties show no maximum. The specific electrical conductivity has a minimum and the leakage current of anodically anodized samples exhibits a maximum at an alloy concentration of 50%Nb/50%Ta. Such alloys which might be fabricated from inexpensive unseparated niobium–tantalum powder represent advantageous heating element material for vacuum furnaces. Their application as electrodes for electrolytic capacitors and in the chemical industry requires low niobium contents of the alloys. (auth)

14088

AN INVESTIGATION OF THE NEPTUNIUM–URANIUM EQUILIBRIUM DIAGRAM. P. G. Mardon and J. H. Pearce (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Less-Common Metals 1, 467-75(1959) Dec. (In English)

The general form of the neptunium–uranium phase diagram was determined by thermal analysis, dilatometry and x-ray techniques, using a very limited amount of neptunium. The results show that there is high solubility of uranium in the α and β phases of neptunium and of neptunium in the α and β phases of uranium; the room temperature solubility of neptunium in α-uranium has the unusually high value of 43 wt %. Some uncertainty exists as to whether or not there is complete solid solubility between γ-neptunium and γ-uranium but any miscibility gap is definitely very restricted. There is one intermediate phase in the system, stable up to temperatures around 650°C and existing between 75 and 48 wt % neptunium at room temperature. Its crystal structure is simple cubic (a = 10.6 A) and it is isomorphous with the ζ phase in the plutonium–uranium system. (auth)

14089

THE NIOBIUM–RHENIUM SYSTEM. A. G. Knapton (Associated Electrical Industries, Aldermaston, Berks, Eng.). J. Less-Common Metals 1, 480-6(1959) Dec. (In English)

The constitutional diagram of the niobium–rhenium system was determined over the whole range of compositions. Two intermediate phases occur in the system, one with the sigma structure (σ) and the other an α-manganese type (χ). The sigma phase is formed peritectically at 57 at. % rhenium and exists over only a small range of compositions and temperatures. The chi (χ) phase melts congruently at 2800°C and has a homogeneity range of 62-87% rhenium, which falls little with decreasing temperature. Niobium dissolves up to 46 at. % rhenium at the eutectic temperature, falling to 43% at 1000°C. The solubility of niobium in solid rhenium is low. (auth)

14090

THORIA AS A FERTILE COMPONENT FOR A LIQUID METAL BREEDER BLANKET. A. Brown and A. Chitty (General Electric Co., Ltd., Wembley, Eng.). J. Nuclear Energy, Pt. B. Reactor Technol. 1, 145-52(1960) Mar.

The crystal chemistry and physics of thoria are reviewed with emphasis on the properties required to form a stable suspension of thoria in liquid bismuth. The variation of the density of thoria with temperature was determined accurately over the temperature range 0 to 1100°C and a measurement of the adsorbed gas (CO_2 and CO) was made. It is shown that thoria is intrinsically wetted by bismuth provided the thoria surface is free from contamination. The solution of certain elements in the bismuth is shown to cause wetting of thoria produced by decomposition of thorium salts, and some elements are shown to reduce thoria with subsequent formation of $ThBi_2$. A suspension of thoria in liquid bismuth containing an added element E is stable if the following relationship is satisfied: $-\Delta G_{ox}(C) < -\Delta G_{ox}(E) < -\Delta G_{ox}(Al)$, where $-\Delta G_{ox}(A)$ is the free energy of formation of the most stable oxide of A. The results are discussed in terms of the thermodynamics of oxidation/reduction processes. (auth)

14091

THE NATURE AND PROPERTIES OF TRANSITION METAL HYDRIDES. G. G. Libowitz (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Nuclear Materials 2, 1-22(1960) Mar. (In English)

The basic chemical and physical properties of transition metal hydrides are reviewed with emphasis on the hydride phases rather than dilute solutions of hydrogen in metals. The review includes discussions of the phases present in metal-hydrogen systems, their crystal structures, pressure-composition-temperature relations, thermodynamic properties, and electrical and magnetic properties. The nature of transition metal hydrides is considered. Evidence is given to show that they are definite chemical compounds (rather than solid solutions) having some degree of ionic character. The large deviations from stoichiometry exhibited by these compounds are explained on the basis of lattice defects. (auth)

14092

THE TRANSFORMATION TEMPERATURES OF HIGH-PURITY URANIUM. Bernhard Blumenthal (Argonne National Lab., Lemont, Ill.). J. Nuclear Materials 2, 23-30(1960) Mar. (In English)

The transformation temperatures of high-purity uranium were determined by repeated thermal analyses where the rates of heating and cooling were independently controlled. The solid state transformation temperatures and the logarithm of the heating or cooling rates were found to be related linearly. The extrapolated functions intersect at a point where the disturbing effects of hysteresis, superheating, and undercooling disappear, i.e. at the equilibrium temperature. The transformation temperatures were determined to be 667.7 ± 1.3°C for $\alpha \rightleftharpoons \beta$ and 774.8 ± 1.6°C for $\beta \rightleftharpoons \gamma$. The mean temperature for melting and freezing was determined to be 1132.3 ± 0.8°C. (auth)

14093

ATTACK OF GRAPHITE BY AN OXIDISING GAS AT LOW PARTIAL PRESSURES AND HIGH TEMPERATURES. J. E. Antill and K. A. Peakall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials 2, 31-8(1960) Mar. (In English)

Experiments were performed to determine the kinetics of the oxidation of graphite at 900 to 1000°C in argon containing small amounts of oxygen, water vapor, carbon dioxide, hydrogen, and carbon monoxide. The reactivity of the gases decreased in the order: oxygen, water vapor, and carbon dioxide. The reaction rates increased with temperature and with the partial pressure of the oxidizing gas, while hydrogen and carbon monoxide inhibited attack by water vapor and carbon dioxide, respectively. The relationships between the reaction rates and the partial pressures of the gases were in good agreement with theory, previous work, and the supposition that hydrogen atoms are adsorbed on graphite in contact with hydrogen and water vapor. (auth)

14094

AN EXPERIMENTAL DETERMINATION OF THE CHARACTERISTIC TEMPERATURE FOR PuO_2. R. B. Roof, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Nuclear Materials 2, 39-42(1960) Mar. (In English)

The characteristic temperature for PuO_2 was determined by measuring the reduction in intensity of x-ray diffraction spectra from a specimen as the specimen temperature is increased. To evaluate the technique employed, the characteristic temperature of aluminum was also determined. For aluminum, a characteristic temperature of 393°K was obtained. The characteristic temperature of PuO_2 was found to be 415°K. (auth)

14095

AGEING AND HOT HARDNESS CHARACTERISTICS OF CERTAIN THORIUM ALLOYS. G. H. Bannister, R. C. Burnett, and J. R. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials 2, 51-61(1960) Mar. (In English)

Aging experiments at 500, 600, and 700°C on thorium-rich thorium—aluminum and thorium—uranium alloys are described. The results of similar tests at 600°C on five more complex thorium alloys are given. Hot hardness tests at temperatures up to 800°C were made on three samples of thorium and on several Th—Al, Th—U, and Th—Zr alloys in the as-cast, solution treated, and aged conditions. Aluminum additions improved the hot hardness of thorium and the alloys showed considerable hardening due to precipitation of Th_2Al. The rate of aging increased directly with aluminum content and with temperature while the maximum hardness for a given composition increased inversely with temperature. Little precipitation hardening was observed in thorium—uranium alloys containing up to 3 at.% uranium and their hot hardness behavior showed little significant improvement over unalloyed thorium. The results on thorium—zirconium alloys suggested that zirconium additions within the α-thorium solid solution range lead to solution hardening. In an alloy containing 22 at.% zirconium, higher hot hardness values, up to 600°C, were obtained after solution annealing in the β (body-centred cubic) phase-field than after solution treatment in the (α + β) field. Additions of aluminum and uranium in excess of the solubility limit restricted the grain growth of thorium at 1150 and 1200°C, respectively. (auth)

14096

NEUTRON STUDY OF THE CRYSTALLINE TEXTURE OF URANIUM BARS. J. Laniesse, P. Meriel, and M. Englander (Centre d'Etudes Nucléaires, Saclay, France). J. Nuclear Materials 2, 69-74(1960) Mar. (In French)

The method of studying textures by neutron diffraction was applied to a uranium bar extruded in the α range at 600°C. By means of a single series of experiments, a good statistical image of the texture was obtained. The specimen was a cylinder of about 5 cm^3, the axis of which, normal to the direction of drawing, coincided with the axis of a beam of monochromatic neutrons (λ = 1.143 A). The neutron detector was a BF_3 counter which describes a circle in a horizontal plane, centered on the specimen. The diffraction spectrum obtained from a piece of uranium bar, extruded in the α-range and treated in the β-range, revealed that this specimen has only a weak degree of preferred orientation, whereas an as-extruded specimen shows a marked [110] texture in the direction of extrusion. The results obtained are in agreement with those determined by x-ray diffraction by various authors with uranium bars extruded or rolled in the α-range. (auth)

14097

DETERMINATION OF THE THERMOELECTRIC POWER OF URANIUM AND PLUTONIUM. P. Costa (Centre d'Etudes Nucléaires, Saclay, France). J. Nuclear Materials 2, 75-80(1960) Mar. (In French)

The thermoelectric power of uranium and plutonium was measured by a differential method. A high value of thermoelectric power was found for the α and β phases of plutonium, and a low value for the δ and ϵ phases, particularly the δ. This last result rules out Varley's explanation for the negative thermal expansion coefficient of the β phase. The observed variation of the thermoelectric power with temperature is slightly different from that reported by Waldron and Lee. (auth)

14098

THE URANIUM—MOLYBDENUM EQUILIBRIUM DIAGRAM BELOW 900°C. Austin E. Dwight (Argonne National Lab., Lemont, Ill.). J. Nuclear Materials 2, 81-7(1960) Mar. (In English)

The U—Mo equilibrium diagram was determined up to 19 wt.% Mo and below 900°C. The eutectoid transformation $\beta \rightleftharpoons \alpha + \gamma$ was located at 639 ± 5°C. The limit of the $\beta + \gamma$ field was placed at 4.5 wt.% Mo at the eutectoid temperature. The γ phase underwent a eutectoid transformation at 10.5 wt.% Mo and 565 ± 5°C, to $\alpha + \delta$. The tetragonal structure of the δ phase was confirmed, with c_0 = 9.854 A, a_0 = 3.427 A, and c/a = 2.876. It is considered probable that the δ phase is formed by a congruent transformation. (auth)

14099

THE NATURE OF SUBGRAIN BOUNDARIES DUE TO PHASE TRANSFORMATION IN URANIUM. R. W. Cahn and H. Tomlinson (Univ. of Birmingham, Eng.). J. Nuclear Materials 2, 88-9(1960) Mar. (In English)

Experiments were performed which confirmed the hypothesis that subgrains in $\beta \rightarrow \alpha$ transformed uranium are due to a strain-induced form of polygonization of glissile dislocations in the α-uranium lattice. (C.J.G.)

14100

PHASE CHANGE AND DISORDERING BY IRRADIATION OF THE COMPOUND U_2Mo. J. Bloch (Centre d'Études Nucléaires, Saclay, France). J. Nuclear Materials 2, 90-1(1960) Mar. (In French)

Plates of U_2Mo were homogenized at 1050°C and heated at 500°C for 7 days to obtain ordered, quadratic γ' phase. Irradiation by a thermal neutron flux at 2×10^{10} to 2×10^{12} n/cm^2/sec below 65°C produced a disappearance of order lines and a transition from quadratic γ' to cubic γ. The data are plotted and indicate that a continuous phase change takes place. (T.R.H.)

14101

ALLOTROPIC TRANSFORMATIONS IN PLUTONIUM. J. D. Hill (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature 186, 304-5(1960) Apr. 23.

Measurements were made on the rate of allotropic transformations in plutonium at temperatures ranging from 25 to 245°C. Rate of transformation was read from a record of dilatation against time, using a transducer system capable of high sensitivity over a wide range and of proved stability. Results are presented graphically. (C.H.)

14102

ELECTRIC FURNACE STEEL FOR NUCLEAR APPLICATIONS. C. Jamieson and J. Mowat (Wm. Beardmore & Co., Ltd., Glasgow). Nuclear Eng. 5, 207-11(1960) May.

Steel produced in the electric arc furnace has improved mechanical properties compared with that manufactured by the open hearth process; the reason for this improvement probably lies in the smaller amount of oxide and sulfide inclusions. Results of analyses of the composition of various electric furnace forgings (solid disks and bars, hollow rings, and nozzles) are given, and they show low sulfur and phosphorus contents and high Charpy impact values, both well within specifications for steel for reactor pressure vessel construction. The effects of aluminum addition (necessary to neutralize the effects of nitrogen) on the Charpy impact values are shown to be mostly beneficial. Plates tested in a reactor pressure vessel and the effects of aluminum addition on their mechanical properties are also discussed. It is pointed out that electric furnaces working on 100% scrap charges will give higher contents of residuals (such as copper and nickel) and of nitrogen. (D.L.C.)

14103

A METHOD FOR DETERMINING THE TENSILE PROPERTIES OF METALS AT HIGH RATES OF STRAIN. A. L. Austin and R. F. Steidel, Jr. (Univ. of California, Berkeley). Proc. Soc. Exptl. Stress Anal. 17, 99-114 (1959).

An experimental method was developed to determine the dynamic tensile properties of materials at the high rates of strain experienced during the final stages of plastic deformation to fracture. An explosive impact tensile tester was designed with provisions for direct and accurate measurements of load, impact velocity, and instantaneous changes of diameter as a function of time. A charge of gunpowder was used to propel a projectile threaded to one end of a specimen, the other end being fixed. A load-time history was obtained from an oscilloscope record of the output of two resistance wire strain gages mounted at the fixed end of the specimen. With silhouette lighting, a high speed framing camera operating at 170,000 frames per second was used to photograph the specimen over the interval of time from necking to fracture providing a permanent visual record of the instantaneous change of diameter with time. By this method dynamic stress-strain curves were obtained for various true strain rates. Data for steel and aluminum alloy were obtained to verify the experimental apparatus and method. These data consisted of fracture stresses, impact velocity, reduction of area, total elongation, and strain rate. Dynamic stress-strain curves for these materials indicated that strength increases with strain rate at room temperature. The tensile properties of these materials were obtained for strain rates as high as 17,000 in./in./sec by this method. (auth)

14104

X-RAY SCATTERING OF CARBON BLACK. E. G. Steward and B. P. Cook (General Electric Co., Ltd., Wembley, Eng.). Research (London) 13, 163-4(1960) Apr.

Samples of Magecol-555 lampblack carbon were calcined at various temperatures up to 2000°C, and its x-ray scattering at small angles 3 to 20° (2θ) was studied. In this range of angles, each sample gave a distinctly different scattering vs. 2θ curve, with all the maxima near 3°. These differences were correlated well with porosity calculated from density by helium displacement. The shift of the scattering maxima to smaller angles for calcination temperatures above 1000°C is interpreted to correspond with pore growth, and this interpretation is supported by the sharp increase in the rate of gas evolution. Increased helium density above 1000°C is also interpreted to mean that the pores are accessible to helium. (D.L.C.)

14105

PREPARATION AND PROPERTIES OF SAMARIUM HEXABORIDE. G. V. Samsonov, N. N. Zhuravlev, Yu. B. Paderno, and V. R. Melik-Adamyan (Academy of Sciences, Ukrainian SSR and Lomonosov Moscow State Univ.). Soviet Phys.- and Cryst. 4, 507-9(1960) Apr.

Samarium hexaboride, which is cubic and of CaB_6 type, was prepared by the boron and the boron carbide methods: $Sm_2O_3 + 15B = 2SmB_6 + 3BO$ and $Sm_2O_3 + 3B_4C = 2SmB_6 + 3CO$. The powdered reactants were pelletized then fired at ~1600°C under vacuum for one hour. The resulting SmB_6 was pulverized, and its properties were determined. (B.O.G.)

14106

THE BORIDES OF PRASEODYMIUM ERBIUM, AND TERBIUM. G. V. Samsonov, Yu. B. Paderno, and T. I. Serebryakova (Academy of Sciences, Ukrainian SSR). Soviet Phys.- Cryst. 4, 510-12(1960) Apr.

The borides of erbium, praseodymium, and terbium were prepared by reducing the oxides with boron and boron carbide *in vacuo* at 1500 to 2000°C. The B_4C method produced PrB_6 only and gave the result a = 4.12 A. The boron method gave a tetragonal ErB_4(UB_4 structure) with a = 7.08 A and c = 4.02 A for firing at 1600 to 2000°F. An intense blue color was deposited at 1800°C in the cooler parts of the furnace; the color is typical of rare-earth hexaborides. Both methods were used to make TbB_6 at 1650°C. Results show a = 4.11 A, in agreement with those for other rare-earth hexaborides. The B_4C method gave a grey-brown product of TbB_4 with a = 7.13 and c = 4.07 A. (B.O.G.)

14107

TEMPERATURE DEPENDENCE OF CLOSE ORDER PARAMETERS IN Ni_3Pt. A. A. Katznel'son. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 4, 131-40(1959). (In Russian)

The temperature dependence of close order parameters in Ni_3Pt was determined by measuring the diffusion scattering intensity on polycrystals. The kinetics of close order at 700°C was determined, and the close-order temperature function was studied. It is shown that the parameter of close order α slowly drops with a rise in temperature and even at 1050°C retains considerable Ni diversion in the stoichiometric composition of the sphere around Pt. Concentrations of heterogeneities become equilibrate at 1000°C. (R.V.J.)

14108

RELATION OF ELECTRIC RESISTANCE TEMPERATURE DEPENDENCE AT LOW TEMPERATURES TO THE GALVANOMAGNETIC EFFECT IN STRONG MAGNETIC FIELDS. O. S. Galkina and L. A. Chernikova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 3-6(1960) Jan. (In Russian)

A study was made of the electric resistance of nickel–copper alloys with 39.6, 44.55, or 49.6% Cu in the 7 to 30°K temperature range. By applying the $T^{3/2}$ law to the temperature dependence of spontaneous magnetization I_s, specific resistivity ρ can be related to ferromagnon concentration $n = 1 - I_s/I_0$ (I_0 – intensity of magnetization for $T \to 0$) and the numerical value of the coefficient $(\rho - \rho_0)/n$ can be obtained (ρ_0 – residual resistance). Comparison of this coefficient's value with $\Delta\rho/\Delta n$ ($\Delta\rho$ and Δn denote variations of ρ and n caused by changes of true magnetization in strong magnetic fields), demonstrates that these values are of the same order within the margin of errors of measurement. This fact is regarded as indirect confirmation of the assumption that resistance of ferromagnetic alloys at low temperatures is related to electron scattering on the irregularities of the lattice magnetic moments. (auth)

14109

DETERMINATIONS OF MICROSCOPIC PARAMETERS OF ALUMINIUM OUT OF ITS OPTICAL CONSTANTS AND ELECTRIC CONDUCTIVITY. A. I. Golovashkin, G. P. Motulevich, and A. A. Shubin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 51-5(1960) Jan. (In Russian)

Measurements were made of the optical constants of aluminum in the 0.8 to 9μ range at room temperature and at liquid nitrogen temperature. Static conductivity and density of the same specimens were also measured. The data obtained were evaluated using theory based on the quantum kinetic equation, taking into account the electron-electron collisions. Concentrations of conduction electrons, electron velocity on the Fermi surface, and electron collision frequency were determined. (auth)

14110

CONTRIBUTION TO THE STUDY OF ORDER IN SPINELS AT HIGH TEMPERATURES. M. Huber. p.19-21 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

The structure of $CdGa_2O_4$ is of the $M^{II}M_2^{III}O$ spinel type and can be described in terms of oxygen tetrahedra and octahedra. During 1100 to 1250°C heat treatment of samples prepared from nitrate solutions, small amounts of CdO are lost. The samples remain single-phase compounds unless they are heated to higher temperatures at which decomposition takes place and free gallium oxide appears. It was noted that the samples which lost a large amount of CdO were well sintered and that in the free solid CdO, which was of NaCl-type structure, the Cd atoms were in octrahedral sites. These experiments can be considered as a proof of the theory that the fourfold coordination of cadmium is more stable than the sixfold coordination. (B.O.G.)

14111

DIFFUSION IN OXIDES. W. D. Kingery. p.37-44 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

The diffusion characteristics of stoichiometric and nonstoichiometric oxides were investigated for intrinsic and impurity-controlled diffusion coefficients. The Nernst-Einstein equation is given for the diffusion coefficient. The ion mobility was investigated for a system of composition $Zr_{0.85}Ca_{0.15}O_{1.85}$ ($CaO-ZrO_2$) by determining the electrical conductivity at various oxygen pressures and temperatures. Diffusion coefficients were calculated for the system from the conductivity data. Diffusion coefficients were determined for CoO, FeO, and ZnO as intrinsic nonstoichiometric semiconductors. It was found that small amounts of cations, having variable oxidation states, have large effects on the electrical conductivity properties of stable oxides. (B.O.G.)

14112

OXYGEN ION SELF-DIFFUSION IN URANIUM DIOXIDE. J. Belle and A. B. Auskern. p.44-9 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Oxygen ion self-diffusion in uranium dioxide was studied by means of the exchange reaction between O^{18}-enriched uranium dioxide and CO_2 gas of natural O^{18} content. Diffusion coefficients obtained at 450 to 600°C for the nearly stoichiometric oxide are shown in an Arrhenius plot. A phase diagram is given for uranium oxides from UO_2 to U_5O_{13} for O/U atom ratios of 2.0 to 2.7. (B.O.G.)

14113

DIFFUSION OF OXYGEN IN RARE-EARTH OXIDES. U. E. Kuntz and L. Eyring. p.50-7 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Methods are described for the study of oxygen diffusion in praseodymium and terbium oxides. Tensiometric studies of PrO_2 suggest that five reactions may be studied when heated in vacuo, if appropriate temperatures are chosen. The five reactions reduce PrO_2 to $PrO_{1.50}$. Differential thermal and thermogravimetric analyses plots are given for $PrO_{1.83}$ at 200 to 1400°C. An air ignition was used to prepare the $TbO_{1.835}$ sample. Thermogravimetric analyses of $TbO_{1.83}$ indicates reduction reactions at $TbO_{1.81}$ and $TbO_{1.71}$. A vacuum reduction plot of composition as a function of time for the $TbO_{1.71} = TbO_{1.50} + 0.105\ O_2$ is given. Among the reactions studied, only the reduction of $PrO_{1.71}$ follows the predicted behavior for diffusion of oxygen from compact particles. The $PrO_{1.81}$ reduction appears to follow a classical phase-boundary-controlled process. The TbO reactions are similar and appear to be diffusion controlled in later stages, modified perhaps by phase-boundary considerations. The activation energies, 40 to 50 kcal/mole, imply that the reaction process involves the movement of oxygen from normally chemically bound anion positions. (B.O.G.)

14114

THE MECHANISM FOR ATOM MOTION IN GRAPHITE CRYSTALS. Manuel A. Kanter. p.61-6 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Three mechanisms for self-diffusion in graphite are considered: interstitial, direct interchange, and vacancy. Diffusion measurements were obtained from heating graphite in $C^{14}O$ at 1575°C for 30 min, then burning slowly and measuring radioactivity in carbon dioxide produced. Energy parameters for diffusion in graphite are given which were calculated by Dienes' method assuming 124 kcal/mole for the heat of sublimation of graphite. The property changes in irradiated graphite are discussed following the production of interstitials and vacancies in the lattice. Property changes may be measured at room temperature by cooling to the extent that excess vacancies cannot diffuse to sites at which they can be destroyed. (B.O.G.)

14115

KINETICS OF GRAPHITIZATION. S. Mrozowski. p.264-70 of "Kinetics of High-Temperature Processes." W. D. Kingery, ed. Cambridge, Mass., Massachusetts Institute of Technology and New York, John Wiley & Sons, Inc., 1959. 342p.

Graphitization is a process that begins with a carbonaceous substance and, as a result of heat treatment, ends as graphite. Polymerization is the first and essential step in this process. Cross links between molecules must be established to prevent the molecules from evaporating as the temperature is increased. The changes which occur in such carbonaceous polymerized solids when they are heat-treated to increasingly higher temperatures are described. At 1700 to 2500°C, the small turbostratic crystallites of carbon begin gradually to transform into crystallites of graphite. These crystallites possess a three-dimensional order in which consecutive aromatic planes are arranged in definite relative positions. In the primary process of crystalline growth, even at 2000 to 2500°C the crystallite size is dependent on the highest temperature attained. (B.O.G.)

14116

THE STRUCTURE OF SOLID SOLUTIONS WITH ZIRCONIA BASE. R. Collongues, J. Stöcker, and M. Moser (Centre National de la Recherche Scientifique, Paris). p.23-37 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

The modifications in the structure of zirconia caused by the dissolution of metal oxides were studied. The solid solutions were prepared by coprecipitation in the amorphous state from a mixture of salt solutions of the two compounds. The oxides studied were MgO, NiO, FeO, ZnO, MnO, CdO, Al_2O_3, Mn_2O_3, V_2O_3, CaO, La_2O_3, Nd_2O_3, Sm_2O_3, Gd_2O_3, Y_2O_3, Sc_2O_3, Cr_2O_3, Fe_2O_3, B_2O_3, ThO_2, CeO_2, UO_2, ZrO_2, SnO_2, TiO_2, GeO_2, V_2O_5, MoO_3, SiO_2, BaO, SrO, and BeO. The results of the observations showed the existence of three very sharply defined regions: the region of oxides forming stable cubic solid solutions with zirconia, the region of oxides forming quadratic solid solutions with zirconia, and the region of oxides forming metastable solid solutions with zirconia. The oxides forming stable cubic solutions are characterized by having a value of the ratio V_c/V_a (the ratio of the volume of the cation to the volume of the anion) higher than the value of the ratio V_{Zr}/V_O for the zirconia and by an electronegativity of the cation lower than that of the zirconium. The oxides forming quadratic solid solutions are characterized by a value of the ratio V_c/V_a lower than the value of the ratio V_{Zr}/V_O and an electronegativity of the cation higher than that of zirconium. (J.S.R.)

14117

PREPARATION AND STRUCTURE OF SOME COMPOUNDS FORMED BY ZIRCONIA WITH OXIDES OF TRIVALENT OR TETRAVALENT METALS. M. J. Stöcker, M. Moser, and M. R. Collongues (Centre National de la Recherche Scientifique, Paris). p.39-49 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

A study was made of the preparation and structure of some compounds of ZrO_2 with trivalent and tetravalent metal oxides. The formation of compounds in the zirconia–rare metal oxide systems was investigated with emphasis on the $ZrO_2-La_2O_3$ system. Samples containing 11, 21, and 33 mole % La_2O_3 were prepared by the coprecipitation method. The Debye-Scherrer diagrams showed that a stabilized cubic zirconia phase is obtained in which the lattice constants increase regularly with the La_2O_3 concentration. Heating the samples to 1000, 1100, and 1350°C causes the progressive disappearance of this phase and the appearance of the pyrochlore phase with the composition $La_2Zr_2O_7$. The possibility of forming extended solid solutions with bivalent metal oxides was investigated by coprecipitation from a mixture of zirconium oxychloride, beryllium nitrate, and lanthanum chloride and with substitution of MnO for BeO. The mechanism for the formation of the extended solid solutions is discussed. Compounds of the pyrochlore type were also found in ZrO_2 systems with the oxides of Ce, Sm, Nd, and Y. The tetravalent metal oxide systems studied were ZrO_2-GeO_2, ZrO_2-TiO_2, and ZrO_2-SnO_2. The compound $ZrGeO_4$ was prepared by the method of coprecipitation. It has the structure of $CaWO_4$. The dilatometric analysis curve showed no anomalies between 20 and 1300°C. In the equilibrium diagram no phase exists between the $ZrGeO_4$ and the GeO_2 phases in samples containing less than 50% ZrO_2. In samples containing 33% GeO_2 a new phase with a quadratic structure appears with $a = b = 4.955$, $c = 5.222$, and $c/a = 1.054$. In the ZrO_2-TiO_2 system the compound $ZrTiO_4$ with an orthorhombic structure was found. The range of homogeneity of the $ZrTiO_4$ extends from 47 to 55 mole % TiO_2 at 1200°C. Between 1200 and 800°C no appreciable variation of the extent of this region is observed. The dilatometric analysis curve shows no anomaly. The compound is reduced by heating under vacuum at 1000°C for five hours. No compound was found in the ZrO_2-SnO_2 system. In samples containing 30 to 60% SnO_2 a new phase was found with equimolecular concentrations of the two oxides. It has an orthorhombic structure with the parameters $a = 4.87$, $b = 5.19$, and $c = 5.65$. The phase is metastable. The compounds formed by zirconia with the oxides of monovalent and bivalent metals are briefly discussed. (J.S.R.)

14118

THE SULFIDES OF THE ELEMENTS OF THE YTTRIUM SERIES. M. J. Flahaut, M. Guittard, M. J. Loriers, and M. Patrie (Faculté de Pharmacie, Paris). p.51-6 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

The sulfides Me_2S_3, Me_2O_2S, Me_5S_7, and MeS were prepared from dysprosium, yttrium, and erbium. The crystallographic properties of the compounds isolated were determined, and their principal chemical and physical properties were studied. The determination of their fusion points showed that these sulfides are less refractory than the ceric sulfides. (J.S.R.)

14119

GENERALITIES ON THE RESISTANCE TO THERMAL SHOCK OF REFRACTORY MATERIALS. P. Lapoujade. p.91-100 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

A survey is given of the methods used in France and in other countries for the investigation of the resistance of refractory materials to thermal shock. The progress made in knowing the most important characteristics determining the behavior of refractory materials under thermal shock is analyzed. The international theoretical work on this subject is reviewed. (J.S.R.)

14120

PRINCIPLE AND APPLICATION OF THE SYSTEMATIC METHOD FOR THE MEASUREMENT OF RESISTANCE TO THERMAL SHOCK. S. Tacvorian (Office National d'etudes et de Recherches aéronautiques, [Paris]). p.101-15 of "High Temperature Chemistry. Second National Conference, Paris, November 28, 1957." Paris, Centre National de la Recherche Scientifique, 1959. (In French)

When a relatively poor conductor is abruptly cooled, a fissuration perpendicular to the axis of the sample occurs. For a given sample under given conditions of thermal shock, there is a constant and precise relationship between the cracking and the lowering of the complete physical properties of the sample. By a study of the variation of the ratio σ/σ_0, the resistance to bending before and after thermal shock, as a function of the temperature variation, the thermal shock behavior of a material can be characterized. Experimental data showed that the resistance to thermal shock of the following materials increases in the order given: Al_2O_3, Chromal AB_5, Chromal ABF_5, and Chromal AB_7. It was shown that alumina fissured by the effect of thermal shock is adjusted by "refrittering" from 1500°C. (J.S.R.)

14121

IMPROVED SILVER ALLOY FOR THE CONTROL RODS OF NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). British Patent 832,959. Apr. 21, 1959.

An improved Cd–Ag–In control rod material is offered. An addition of 0.5 to 1.5% of Pt, Ru, Rh, Os, or Pd improves structural strength. (T.R.H.)

14122

IMPROVEMENTS IN OR RELATING TO METHODS OF

TREATING METALLIC POWDERS SO AS TO INCREASE THE DENSITY THEREOF. (to Commissariat à l'Énergie Atomique). British Patent 833,262. Apr. 21, 1960.

It is desirable for producing molded sintered compacts to start with a fine, dense, lamellar powder. A rolling process is described for producing metal powders with such properties. The fine powder is passed between steel rollers moving at slightly different speeds, for example, 24 and 26 rpm at 200 kg pressure. In the example, oxidized Al powder of 2.5 μ size is used. Powder densified by the process resulted in a harder, stronger sintered bar. (T.R.H.)

Radiation Effects

14123 CF-52-3-172
Oak Ridge National Lab., Tenn.
INDUCED ACTIVITY IN COOLING WATER—ARE. T. H. J Burnett. Mar. 24, 1952. 2p. Contract [W-7405-eng-26]. OTS.

Conservative and upper limit approximations and estimates were used to calculate the amount of radioactivity induced in the mineral content of once-through untreated cooling process water. No significant hazard is seen to be probable except for the possibilities associated with scale formation. This cooling water in passing through a heat exchanger is in a neutron flux due to delayed neutrons arising in nearby circulating reactor fuel. (auth)

14124 GA-1093
General Atomic Div., General Dynamics Corp., San Diego, Calif.
IRRADIATION EFFECTS ON THE SURFACE REACTIONS OF METALS. Summary Report [for] October 1, 1958 to November 1, 1959. F. D. Carpenter and J. L. White. Dec. 15, 1959. 40p. Project No. 37. Contract AT(04-3)-179. OTS.

Weight increases during the oxidation of irradiated foils of pure copper were greater than for unirradiated specimens. Enhanced reactivity appeared to be strongest in the thin-film region up to about 5 $\mu g/cm^2$. Oxide film (Cu_2O) thickness for both irradiated and unirradiated specimens was ~1200 A. Radiation did not affect the reduction of Cu_2O during the induction period (period in which the reduction proceeds very slowly or not at all). In later stages of the reduction process, a serious lack of reproducibility was observed. Radiation effects on films of Cu_2O formed by prior oxidation of the copper substrate decreased the kinetics of secondary oxidation. The secondary oxidation curve exhibited a large gap at the point of interruption for irradiation. The development of an automatic recording microbalance of high sensitivity and a furnace for studies in reactor radiation fields is reported. Measurements were made of the electrode potentials of irradiated (3.3×10^{19} neutrons cm^{-2}) copper, aluminum, magnesium, and zirconium. Cell potentials were found to be dominated by the oxide films formed on the electrode surfaces. The results indicate that radiation does affect the local anode reaction potential. No significant difference between the rates of the dissolution reaction of cold-worked and annealed copper specimens in $Fe(NO_3)_3$ was observed. Results on irradiated specimens indicated that irradiation enhanced the reactivity of copper specimens on the order of 5%. Irradiated copper specimens developed etch pits at a slightly greater rate than unirradiated specimens in $Fe(NO_3)_3$ solutions at 5°C. (C.J.G.)

14125 NAA-SR-3250
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PROCEEDINGS OF THE LATTICE DEFECTS IN NOBLE METALS CONFERENCE HELD AT CANOGA PARK, CALIFORNIA, OCTOBER 16 AND 17, 1958. J. A. Brinkman, C. J. Meechan, and A. Sosin, eds. 131p. Contract AT-11-1-GEN-8. OTS.

The preconference summaries of papers and a transcript of a two-day discussion held as a conference on lattice defects in noble metals are presented. Delegates from the U. S. and several foreign countries were invited to submit summaries of their views prior to the conference. By use of this technique a better understanding of various approaches was achieved and interpretations of theory and experiment were clarified. (J.R.D.)

14126 NAA-SR-4670
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EVALUATION OF IRRADIATED EXPERIMENTAL OMR FUEL ELEMENTS—1. J. H. Walter, E. E. Garrett, and J. M. Davis. Apr. 1, 1960. 49p. Contract AT-11-1-GEN-8. OTS.

As part of a program to develop an economical fuel cycle for an Organic Moderated Reactor (OMR), experimental fuel elements are being irradiated in the Organic Moderated Reactor Experiment (OMRE). The first two experimental fuel elements have been removed from the OMRE, examined, and evaluated. These extended-surface, plate-type fuel elements had finned aluminum cladding, metallurgically bonded to flat uranium alloy fuel plates. A 0.0005 in. nickel layer was used to prevent interdiffusion between the aluminum and uranium. The fuel core alloys irradiated were U—3.5% Mo and U—3.5% Mo—0.5% Si. These two experimental elements were removed from the reactor after one of the elements released fission products, and cladding temperatures increased on both fuel elements. The maximum measured cladding temperature was 780°F. The maximum fuel burnup was later determined to be 0.23 at. % U. Hot-cell examination revealed that the coolant inlet ends of the fuel elements had filtered particulate matter out of the coolant, which blocked the ends of the coolant channels. Restriction of the coolant flow through the elements caused partial melting of the cladding in one fuel element and a blister on one of the fuel plates from the other fuel element. Dimensions were taken on three of the fuel plates. Metallographic sections from the blistered fuel plates were examined, and burnup profiles were determined for the three plates measured. The fuel had good dimensional stability, which is significant, since the melted cladding and the core microstructure evidenced temperatures substantially above the maximum temperatures recorded by thermocouples. Nothing was observed that would indicate the fuel elements would not have functioned properly in the same coolant if the coolant were free of particulate matter of sizes that could be trapped. (auth)

14127 NP-8469
Rhee Elastic Thread Co., Warren, R. I.
RESEARCH AND DEVELOPMENT ON EFFECTS OF HIGH INTENSITY RADIATION ON NATURAL RUBBER COMPOUNDS. Progress Report No. 2. I. Miller and A. D. Delman. Dec. 3, 1957. 32p. Lab. Project 5900-1.

Two white pigmented unvulcanized natural rubber compounds, formulated with and without sulfur curatives, were prepared for investigation in terms of their resistance to degradation by high-intensity nuclear radiations. Results of tests indicate that the chemically vulcanized compound formulated with sulfur curatives is slightly more resistant to radiation attack than the same material cured by irradiation. In addition, the rate of deterioration of the two unvulcanized compounds studied is independent apparently of the presence of sulfur curatives in the formulation, although appreciably higher peak tensiles are obtained with the sulfur-bearing stock. (auth)

14128 NP-8630
Edgerton, Germeshausen and Grier, Inc., Boston.
A STUDY OF RADIATION EFFECTS ON ELECTRONIC DEVICES. PART I. Second Interim Report [for] September 1, 1959 to November 30, 1959. Harold S. Sauer. Dec. 14, 1959. Decl. Jan. 27, 1960. 94p. DA Project No. 3-19-01-701. Contract DA-36-039 SC-78171. (EG & G-B-2000).

Transient and long term measurements were made on a group of transistors, triodes, and thyratrons at Godiva and TRIGA. The transistors were permanently damaged by both reactor environments. The responses were found to be separable into three distinct parts, each proportional to the dose rate or integrated dose of the pulse. Operation of the triodes as 20 kc amplifiers resulted in a change of gain and operating point for both the Godiva and TRIGA radiation pulses. The triodes were not permanently damaged. The thyratrons, operating as relaxed oscillators, produced an output whose amplitude decreased slightly during the irradiation. This effect was not permanent. (C.J.G.)

14129 NP-8667
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
IN-PILE HALL COEFFICIENT MEASUREMENTS OF GERMANIUM BOMBARDED BY FAST NEUTRONS. Report No. 133/I-B. B. Buras and J. Suwalski. Jan. 1960. 5p.

The Hall coefficient and the electrical conductivity of germanium bombarded by fast neutrons were investigated. The measurements indicate the presence of fast holes. (auth)

14130 SCTM-56-60(51)
Sandia Corp., Albuquerque, N. Mex.
NEUTRON IRRADIATION EFFECTS ON MINORITY CARRIER LIFETIME IN SILICON DIODES. Bruce Wickesberg. Feb. 18, 1960. 15p. OTS.

The junction recovery technique of measuring minority carrier lifetime was employed to determine lifetime dependency on neutron irradiation in silicon. Silicon diodes were exposed at the Godiva II facility to fluxes ranging up to 3×10^{13} nvt. At the high injection currents used, a damage constant, α, defined in the equation $(1/\tau) = (1/\tau_i) + \alpha\phi$ was found to be 1.7×10^{-7} $(\text{nvt} \times \text{sec})^{-1}$. An important aspect of the experiment was that lifetime measurements were made within 0.2 second following irradiation and continually monitored for the following 20 minutes. (auth)

14131 UCRL-5264
California. Univ., Livermore. Radiation Lab.
FAST NEUTRON EFFECTS ON DU PONT 1290 FILM. Seymour Block and Lewis Hughes. June 13, 1958. 7p. Contract W-7405-eng-48. OTS.

Fast neutron effects on a widely used x-ray film were investigated. The neutron flux was provided by the (d,t) reaction of a Cockcroft-Walton accelerator. Integrated exposures to 10^{10} n/cm^2 were given the film. It was found that perturbations on film that were pre-exposed to Co^{60} gamma rays from 10 to 2000 r were negligible. Simultaneous exposure of neutrons plus gammas also indicated negligible effect on the film insofar as the gamma dose was concerned. (auth)

14132 USNRDL-TR-406
Naval Radiological Defense Lab., San Francisco.
RADIATION CHEMICAL EFFECTS ON POLYURETHANES. I. CROSSLINKING. J. F. Pestaner and L. H. Gevantman. Feb. 17, 1960. 12p.

A quick and useful method for measuring radiation damage in polyurethane elastomers was examined by using the relationship between the extent of crosslinking and the degree of swelling in a solvent. A linear relationship was found to exist between radiation dose and crosslinking using three different solvents. Changes in crosslinking were observable for doses as low as 10^6 rads. (auth)

14133 YAEC-158
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
THE WCAP-1 AND 2 CAPSULE IRRADIATION PROGRAM INTERIM REPORT. R. Duncan, J. Jedruch, and R. King. Sept. 1959. 86p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

In-pile capsules containing UO_2 enriched to 2.7 to 5.4% U^{235} with pellet-to-tube diametrical clearances of 0.000 to 0.005 in. were fabricated. Thirteen were placed in the Materials Testing Reactor and five in the Engineering Test Reactor to verify the performance of the Yankee fuel element design under irradiation. Stainless steel (types 304 and 316) cladding exhibited successful performance when exposed to representative fuel burnups under Yankee power ratings. Satisfactory performance of ferrule brazed joints used in irradiation specimen fuel assemblies was determined. In-pile test results indicated that under Yankee irradiation conditions no diametrical dimensional changes of fuel rods greater than 0.0005 inches may be expected. The radial cracking exhibited by uranium oxide pellets produced no apparent effect on pellet fuel performance at the power ratings evaluated. Experimental volumes of fission gases released were considerably lower than theoretical predictions. The above results were determined from tests on 7 of the 18 irradiated in-pile capsules. (C.J.G.)

14134
THE EFFECTS OF γ-RAYS ON THE ELECTRODE BEHAVIOUR OF LITHIUM GLASS. N. A. Fedotov. Atomnaya Energ. 8, 262-4(1960) Mar. (In Russian)

The effects of γ radiation on the properties of lithium-glass electrodes were investigated using a 12-mm tube with 27% Li_2O, 3% Cs_2O, and 67% SiO_2. The data indicate that even under intense γ radiation the sensitivity gradient and resistance (within 0.5 to 1.0%) remain constant while their mean absolute potential variation is 3 mv. (R.V.J.)

14135
THE ABSORPTIVE PROPERTIES OF RADIATION PROTECTION GLASS. W. Jahn (Jenaer Glaswerks Schott & Gen., Mainz). Atompraxis 6, 82-7(1960). (In German)

Irradiation processes in hot cells can be directly observed with the aid of radiation-absorbing glasses. On account of undesirable changes which may appear in the glasses as a result of γ radiation, an exact determination of the extent of discoloration in such glasses is necessary. In addition, a large number of other characteristics must be known, e.g. natural color, reflection, the absorption coefficient in regard to γ radiation, and build-up factors. These data were determined by irradiation experiments, measurements, and calculations. They are a-
form of graphs and tables. (auth)

14136
THE INFLUENCE OF HIGH IRRADIATION DOSES ON THE GAS AND WATER-VAPOUR PERMEABILITY OF SOME PACKING SHEET MATERIALS. Th. Grünewald (Bundes-

forschungsanstalt für Lebensmittelfrischhaltung, Karlsruhe, Ger.). Chem.-Ingr.-Tech. 32, 297-8(1960) Apr. (In German)

The gas and water-vapor permeability of sheets suitable for packing is of considerable importance in the durability of foodstuffs. The influence of high irradiation doses, up to 20 Mr of soft x rays, on the permeability to air and oxygen and also to water vapor with and without contact between the sheet and water is reported for weldable sheets coated with polyethylene. Further, standards are given for the color changes occurring on irradiation of the sheet. (auth)

14137

HOW IRRADIATION AFFECTS METALS. W. L. Fleischmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Iron Age 185, No. 17, 106-7(1960) Apr. 28.

The radiation effects on metals were investigated. Graphs are included for strengths as a function of neutron dosage for 347 stainless steel, impact energy-testing temperature for Carilloy T-1 steel, and stress-strain diagrams for irradiated and unirradiated copper and nickel. It was found that neutrons boost the tensile and yield strengths, lower the impact strength, and increase the safety factor. Large increases in yield strengths occurred for copper and nickel at all test temperatures for dosages of 5×10^{19} n/cm^2. (B.O.G.)

14138

A METHOD OF STUDYING THE ELECTRICAL RECOVERY OF A GAS AFTER A PULSE DISCHARGE. R. J. Armstrong (Royal Radar Establishment, Malvern, Eng.). J. Electronics and Control (1) 6, 162-4(1959) Feb.

The method described was devised for a triggered three-electrode discharge or thyratron. The circuitry for the pulse discharge is shown with an adaptation of the circuit to a two-electrode discharge. (B.O.G.)

14139

RADIO-INDUCED GROWTH OF α-URANIUM AS THE RESULT OF A CORRELATIVE SCATTERING PROCESS. Ulrich Gonser (Gesellschaft zur Förderund der Kernphysikalischen Forschung, Aachen). J. Nuclear Materials 2, 43-50(1960) Mar. (In German)

The correlated collision model was applied to the interpretation of the irradiation-induced growth of α-uranium, and phenomena associated therewith. In the neighborhood of a fission spike, the following processes were found to occur preferentially in the three principal crystallographic directions: [1 0 0], focusons; [0 1 0], dynamic crowdions; and [0 0 1], high concentration of Frenkel pairs. (auth)

14140

THE TENSILE PROPERTIES OF IRRADIATED URANIUM. D. Shaw (U.K.A.E.A. Windscale Works, Sellafield, Cumb., Eng.). Nuclear Eng. 5, 214(1960) May.

The effects of radiation on the tensile properties of uranium were studied at different temperatures for a burn-up range of 210 to 850 Mwd/tonne. For this range, UTS value is relatively constant at 28 to 32 ton/in^2; therefore, irradiation up to 1,000 Mwd/tonne burn-up does not cause a progressive deterioration in strength. The strength and ductility after irradiation are independent of the irradiation temperature in the range of 269 to 467°C. Ductility becomes negligible after a 200 Mwd/tonne burn-up. The effect of annealing at 630°C after irradiation was also studied, and the resulting higher UTS values are ascribed to plastic deformation relieving of stresses and the slight improvement in ductility to precipitation of fission products. Embrittlement during irradiation is ascribed to the anchoring effect of fission product atoms on the dislocation lines. Thermal cycling experiments resulted in strength losses; metallographic examination of the samples revealed intergranular cracks. (D.L.C.)

14141

SOME EFFECTS OF NEUTRON BOMBARDMENT ON MgO CRYSTALS. William C. Schieve, Martin A. Pomerantz, and Romas A. Shatas (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 117, 1473-6(1960) Mar. 15.

Electrical conductivity and post-bombardment conductivity induced in MgO crystals by electron irradiation were investigated following exposure to neutrons in the Brookhaven pile (integrated epi-cadmium fluxes of 4.2×10^{16} n/cm^2 and 5.1×10^{17} n/cm^2, respectively). A change in carrier lifetime was observed. No change in the temperature dependence of the yield was detected, indicating that the mobility of the charge carriers is unaffected by these irradiations. The 1.4-ev shallow trap previously observed was split into two levels by the neutron bombardment. This supports the association of this level with the 2.2-ev optical transition. Optical absorption measurements were conducted in the 0.6 to 3.0-ev range, and a previously unreported peak was observed at 0.74 ev. (auth)

14142

MICROGRAPHIC EXAMINATION OF IRRADIATED URANIUM. J. Bloch and J. Bourgues. Rev. mét. 55, 339-44 (1958). (In French)

Initial results are given of the metallographic study of the uranium of the first three sets of bars withdrawn from the Saclay EL2 pile. Under the influence of irradiation the uranium becomes markedly twinned and its hardness increases. In the case of bars which have given energies in excess of 200 Mw/t, the uranium underwent profound changes in microstructure. The very numerous and fine twins are either curved or displaced through a shear phenomenon, or zones of recrystallization with fine, untwinned regular grains are formed by growth of spherical form. These zones are furrowed by numerous fissures. (auth)

14143

THE EFFECT OF γ-IRRADIATION ON TEXTILE FIBERS. Taro Hisada, K. Wadanabe, T. Uenishi, Y. Mineo, and A. Aino. p.139-43 of "Aisotopu Kenkyu Riyō Sōran, 1956." Tokyo, Japan Atomic Energy Industrial Association, 1957. (In Japanese)

Nylon 115d and 15d, cotton, rayon, vinylon, and wool fibers were irradiated with γ rays from a 160-mc Co^{60} source. The radiation doses ranged from 3.1 to 22×10^6 r. Data on maximum elongation, maximum load, strength, temperature, and amount of radiation are graphed. (OID)

14144

IMPROVEMENTS IN OR RELATING TO IRRADIATION OF METAL ALLOYS. (to Union Carbide Corp.). British Patent 832,484. Apr. 13, 1960.

The improvement of alloying and bonding in metals by irradiation is described. In an example 50 g ZrO_2 and 50 g PbO_2 are suspended in 100 g H_2O and irradiated to 10^8 r/g. On heating to 150 to 200°C, a heterogeneous equilibrium was established and Zr_5Pb_3 was formed. In another example Sudbury Basin Ore was suspended in water and irradiated, centrifuged, and dried. Mixture with stearic acid and paraffin followed by compression to 25,000 lb and heating at 2400°C in a Johnson crucible produced a hard, corrosion-resistant body. (T.R.H.)

14145

IMPROVEMENTS IN OR RELATING TO IRRADIATION OF STARCH. (to Union Carbide Corp.). British Patent 832,746. Apr. 13, 1960.

The irradiation of starch to 10 to 200 × 10^6 r in the presence of small amounts of H_2O and V_2O_5 catalyst improves its properties. In an example 100 g of cornstarch, 100 cc H_2O, and ½ g V_2O_5 are irradiated to 10^8 r. The starch is rendered soluble. The paste centrifuged out dries to a finish desirable in papers and fabrics. The starch product of the irradiation-catalysis process is useful in the food, textile, paper, mining, and tanning industries. (T.R.H.)

14146

IMPROVEMENTS IN VINYL CHLORIDE POLYMER COMPOSITIONS. (to United States Rubber Co.). British Patent 833,610. Apr. 27, 1960.

An irradiated polymer mixture is described which offers improved properties. In an example, four such mixtures were prepared and tested before and after irradiation by high-speed electrons to 20 watt hours per lb. The mixtures all contain 100 parts polyvinyl chloride;, the additions were: 50 parts dioctyl phthalate, 30 parts dioctyl phthalate plus 20 parts styrene, 50 parts di-2-ethylhexyl maleate, 30 parts di-2-ethylhexyl maleate plus 20 parts styrene. The properties of these and other compositions are tabulated. (T.R.H.)

PHYSICS

General and Miscellaneous

14147 AFCRC-TN-59-642

Air Force Cambridge Research Center. Geophysics Research Directorate, Mass.

A RELATIVISTIC TREATMENT OF STRONG SHOCK WAVES IN A CLASSICAL GAS. GRD Research Notes No. 27. Arnold W. Guess. Dec. 1959. 39p. Project 7674. (AD-232531). OTS.

The relativistic Rankine-Hugoniot conditions of Taub are extended to include radiation pressure and energy density. The equations are specialized to the case of a classical gas in front of the shock (neglect of pressure and internal energy compared to rest mass energy density) and found to give strong shocks. Solutions are obtained separately for the cases of a pure material gas and a pure radiation gas behind the shock. The material gas is considered to have a constant ratio of specific heats, $\gamma \leq 2$, or to be itself relativistic, and the case $\gamma = 4/3$ gives the radiation gas results. The rest density compression increases above its nonrelativistic value by a term proportional to β^2 in the lowest order, where β is the ratio of shock velocity to light velocity. For an extreme relativistic shock, this density compression becomes very large (proportional to $[1-\beta^2]^{-1/4}$), but there is no setting-in of degeneracy in the shocked gas. In shock coordinates, the flow velocity ratio across the shock decreases monotonically from its nonrelativistic value of $(\gamma + 1)/(\gamma - 1)$ and approaches the limit $1/(\gamma - 1)$ for an extreme relativistic shock. The complete Rankine-Hugoniot conditions are also used to derive an expression for the velocity of a relativistic sound wave in a medium consisting of a mixture of a thermally perfect material gas and a radiation gas. The expression reduces to known formulas in various limiting cases. (auth)

14148 AFCRC-TR-59-172

Research Technology Associates, Inc., Waltham, Mass.

STUDY OF ELECTRON AND ION BEAMS UNDER OUTER SPACE CONDITIONS. Final Report. J. Babakian. Aug. 15, 1959. 98p. Contract AF19(604)-3895. (AD-229121).

Details of an experimental high-vacuum system design for the evaluation of electron and ion beams under a variety of conditions are presented. Major system components and vacuum gaging techniques are described. Aspects of formation and propagation of electron beams are considered, and designs of electron guns and their uses are discussed along with high-intensity ion sources and beams. (J.R.D.)

14149 AFOSR-TN-59-429

Plasmadyne Corp., Santa Ana, Calif.

FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME III. DIRECT ELECTRICAL CONVERTERS. Emil J. Hellund. Apr. 24, 1959. 72p. Project No. 4750. Contract AF49(638)-332. (E-3FR049-332(Vol. III); AD-214779).

Theory, structure, performance data, and applications of photovoltaic cells and thermoelectric devices are discussed. Other direct electrical converters are briefly mentioned. (W.D.M.)

14150 AFOSR-TN-59-430

Plasmadyne Corp., Santa Ana, Calif.

FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME II. BATTERIES. Emil J. Hellund. Apr. 24, 1959. 98p. Contract AF49(638)-332. (E-2FR049-332(Vol. II); AD-214780).

A summary is presented of performance characteristics, e.g., structure, power weight ratios, and power volume ratios, whenever available of chemical batteries. Performance data include such items as watt hours per pound, watt hours per cubic inch, behavior at low temperatures, unactivated and activated shelf lives, rechargeability, reliability, open circuit voltage, average operating voltage, and adaptability for particular service. Fuel cells and nuclear batteries are discussed. (W.D.M.)

14151 AFOSR-TN-60-297

New York Univ., New York. Inst. of Mathematical Sciences.

EQUATION OF STATE AND PHASE TRANSITION OF THE SPHERICAL LATTICE GAS. Walter Pressman and Joseph B. Keller. Feb. 1960. 24p. Project No. 47501. Contract AF49(638)-341. (HT-5).

The partition function and equation of state of a spherical lattice gas were evaluated by integrating over the surface of a certain sphere. The relationship between the properties of the lattice gas and of the Ising model of a ferromagnet was employed. It was found that in three dimensions the gas condenses, but not in one or two. Graphs of the phase transition curve and of the isotherms in three, two, and one dimensions are presented. (C.J.G.)

14152 AFOSR-TN-60-346

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

IRREVERSIBILITY IN INTERACTING SPIN SYSTEMS. J. Philippot. Mar. 1960. 14p. Contract AF18(600)-1315. (BN-200).

A system whose Hamiltonian is split into two terms $\mathcal{H} = \mathcal{H}_0 + \lambda V$ exhibits two types of irreversible processes. The first processes are described by $\mathcal{H}_0$ alone; only the second processes, which result from the perturbation lead to an increase of the entropy of the system. These processes are illustrated by the examples of free precession and cross relaxation. General formulas are given for transition probabilities and the expressions applied to cross relaxation in LiF agree with the results obtained by Bloembergen and Pershan. (auth)

14153 AFSWC-TR-59-39(Vol. I)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF LUNAR RESEARCH FLIGHTS. L. Reiffel.

June 19, 1959. 298p. Project No. 5776-57853. Contract AF29(601)-1164.

Nuclear detonations in the vicinity of the moon are considered in this report along with scientific information which might be obtained from such explosions. The military aspect is aided by investigation of space environment, detection of nuclear device testing, and capability of weapons in space. A study was conducted of various theories of the moon's structure and origin, and a description of the probable nature of the lunar surface is given. The areas discussed in some detail are optical lunar studies, seismic observations, lunar surface and magnetic fields, plasma and magnetic field effects, and organic matter on the moon. (auth)

14154 ANL-6147

Argonne National Lab., Lemont, Ill.

STRUCTURE DETERMINATION I. Elizabeth Gebert Sherry. Mar. 1960. 16p. Contract W-31-109-eng-38. OTS.

A program to calculate the structure factor or intensity for a given set of reflections written for the IBM 650 is described. Each $\sin^2\theta$, multiplicity, and scattering factor for each element must be entered. The program has space for a maximum of 100 atomic positions and 18 elements. Instruction for an option to calculate cos or sin alone with some saving of time is included. (J.R.D.)

14155 ARGMA-TN-1C1N-24

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

RESEARCH LABORATORY QUARTERLY RESEARCH REVIEW NO. 24 [FOR] NOVEMBER 1, 1959–JANUARY 31, 1960. Mar. 1, 1960. 63p.

Subjects covered include: mathematics, materials, fuels and combustion, nuclear physics, and high temperature physics. (For preceding period see ARGMA-TN-1C1N-23.) (auth)

14156 GAT-DM-829

Goodyear Atomic Corp., Portsmouth, Ohio.

ABSORPTION CORRECTION CALCULATION. D. L. Thomas. Apr. 4, 1960. 13p. OTS.

An IBM-650 computer program is written for the calculation of the absorption correction to x-ray-powder-diffraction lines in the precise determination of lattice parameters. The program is written in two phases: phase I takes the input (x-ray-diffraction data) and by their use evaluates the given equations, producing starting points, lengths, and ordinates of reduced intensity curves. This output from phase I is summed by phase II into the final profile. The necessary equations and operating instructions for the IBM-650 for both phases are given. (D.L.C.)

14157 MH-4

New York Univ., New York. Inst. of Mathematical Sciences.

REMARKS ON ALFVÉN'S PERTURBATION METHOD. O. Fleischman and B. A. Lippmann. Aug. 1955. 13p. Contract AF19(604)-926. (AFCRC-TN-55-854; AD-79010).

Alfvén's perturbation method for treating the motion of a point charge in a magnetic field consists of three elements: (1) The field is regarded, in zero order, as homogeneous. In the next order, the zero-order motion is replaced by its averaged effect, a magnetic dipole, and the interaction of this "equivalent dipole" with the inhomogeneities of the field constitutes the perturbation. (2) The moment of the "equivalent dipole" is constant. (3) If the field is axially symmetric, the "equivalent dipole" moves on the surface generated by rotating a line of force about the polar axis. Alfvén develops his method by the analysis of several special cases. The perturbation scheme is re-derived from a viewpoint that emphasizes general dynamical principles. Thus: (1) is derived directly from Hamilton's principle, (2) is proved by the adiabatic theorem, after noting that the moment of the "equivalent dipole" is an action variable, while (3) is related to the conservation of angular momentum. Remarks under (2) and (3) are intended as an extension of Alfvén's discussion. (auth)

14158 NAA-SR-4764

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DIELECTRIC PROPERTIES OF TERPHENYL MIXTURES. R. J. Sullivan and F. C. Silvey. May 1, 1960. 17p. Contract AT-11-1-GEN-8. OTS.

The electrical properties of a mixture of terphenyls were measured. The data for dielectric constant at 1, 10, and 100 kc are summarized as a function of temperature over the range 375 to 675°F. The dipole moments of the terphenyl isomers are shown to be approximately zero and the induced polarizability is shown to be high. Small composition changes are masked by the much greater effect of temperature on these properties. The dissipation factor varies exponentially with temperature from 375 to 675°F and is inversely proportional to the frequency at 1, 10, and 100 kc. The dissipation factor at 500°F was 0.1, 0.01, and 0.001 ± 100% at 100, 10, and 1 kc, respectively. The volume resistivity decreased from 10^{14} to 10^{11} ohm-cm through the fusion region (154 to 336°F). It decreased due to increasing the temperature from 400 to 600°F through the liquid region from 3×10^{10} to 1×10^{10} ohm-cm. (auth)

14159 NASA-TN-D-271

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

ANALYSIS OF ELASTIC-PLASTIC STRESS DISTRIBUTION IN THIN-WALL CYLINDERS AND SPHERES SUBJECTED TO INTERNAL PRESSURE AND NUCLEAR RADIATION HEATING. Donald F. Johnson. Apr. 1960. 35p. OTS.

A finite-difference analysis utilizing a successive-approximation technique was made using the properties of Inconel X. Distributions of stress and strain for values of heat flux from 50 to 950 watts per cubic centimeter and pressure-times-radius values from 18,000 to 42,000 pounds per inch are presented. The existence of an optimum thickness and other problems unique in the design of a reactor pressure vessel are discussed. (auth)

14160 NP-8414

Convair, San Diego, Calif.

EFFECTS OF SATELLITES ON THE IONOSPHERE. S. Rand and R. A. Pappert. Oct. 1, 1959. 180p. Contract Nonr-2683(00). (ZPh-046)

The effects of satellites on the ionosphere are considered in terms of structure and damping of the wake, application of Bohm-Pines theory to plasma motion, wake structure for highly supersonic flow, non-linear plasma effect, magnetic drag on small satellites, and charge excitation of plasma motion in a magnetic field. Separate abstracts were prepared for five of seven papers. (W.D.M.)

14161 NP-8414(Pt.I)

Convair, San Diego, Calif.

STRUCTURE OF THE SATELLITE WAKE. S. Rand. Jan. 5, 1959. 30p. (ZPh-028)

The particle treatment is applied to a study of the structure of the wake behind a charged body moving supersonically through a low density plasma. For the case of a body whose dimensions are considerably smaller than a Debye length, a solution is obtained which is very similar in structure to the solution obtained by using the linearized fluid dynamics equation. For the case of a disk whose radial dimensions are much larger than a Debye length, two conical regions are found in the wake. At the surface of each of these cones, over thicknesses of the order of a Debye length, the ion and electron densities are increased over their ambient values. Formulas for the electrohydrodynamic drag on a wire and on a large disk are obtained. (auth)

14162 NP-8414 (Pt.II)
Convair, San Diego, Calif.
DAMPING OF THE SATELLITE WAKE. S. Rand. July 30, 1959. 37p. (ZPh-040)

The Landau damping of the ion plasma oscillations which constitute the wake of a line charge moving supersonically through a low-density plasma is studied. Maxwellian distribution functions in the ambient plasma for both electrons and ions have been assumed. It is found that the damping is critical to the question of whether the electrohydrodynamic wake produced by a satellite in the ionosphere is observable, unless the electron temperature is at least an order of magnitude greater than the ion temperature. (auth)

14163 NP-8414(Pt.IV)
Convair, San Diego, Calif.
WAKE STRUCTURE FOR HIGHLY SUPERSONIC FLOW. R. Pappert. Jan. 7, 1959. 13p. (Ph-038-M)

It was previously shown that a particle moving in a plasma with a speed exceeding both electron and ion velocities has two associated wakes. One corresponding to sound excitation, the other to excitation of plasma oscillations. Structure of the two ion wakes associated with a line charge of infinite length moving supersonically with respect to electrons and ions is described. (W.D.M.)

14164 NP-8496
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
QUARTERLY PROGRESS REPORT NO. 56 FOR THE PERIOD ENDING NOVEMBER 30, 1959. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Jan. 15, 1960. 273p. Project 3-99-00-000. Contract DA36-039-sc-78108.

A review of the research activities of the laboratory for the three-month period ending November 30, 1959, is given. Progress is indicated in the fields of physical electronics, plasma dynamics, solid-state physics, low-temperature physics, thermoelectric processes and materials, microwave spectroscopy, nuclear magnetic resonance and hyperfine structure, microwave electronics, atomic beams, stroboscopic research, modulation theory and systems, statistical communication theory, process analysis and synthesis, processing and transmission of information, artificial intelligence, statistical thermodynamics, physical acoustics, speech communication, signal detection by human observers, mechanical translation, communications biophysics, neurophysiology, circuit theory, noise in electron devices, network synthesis, and linguistics. (For preceding period see NP-8100.) (W.D.M.)

14165 NP-8554
Carnegie Inst. of Tech., Pittsburgh.
ELECTROMAGNETIC PROPERTIES OF INSULATORS FROM A MANY-PARTICLE POINT OF VIEW (Thesis). Technical Report No. 12. Vinay Ambegaokar. Mar. 1960. 85p. Project NR 017-620. Contract NONR-760 (13). OTS.

The response of insulators to weak long-wavelength electromagnetic fields is considered from a many-particle point of view. The model used consists of a lattice of nuclei and electrons which interact with these nuclei as well as with each other. The Coulomb interactions between the electrons are allowed to all orders of perturbation theory, and Feynman graphs are introduced to describe the terms of the perturbation series. The perfect insulator and insulator plus one electron systems are discussed. (W.D.M.)

14166 NP-8579
National Aeronautics and Space Administration, Washington, D. C.
SECOND SEMIANNUAL REPORT TO THE CONGRESS [FOR] APRIL 1, 1959–SEPTEMBER 30, 1959. Mar. 17, 1960. 278p.

Progress in the fields of space vehicle development, manned space flight, space sciences, and advanced space and aeronautics research is outlined. In addition growing activities with other nations such as arrangements for a joint U.S.-Canada ionosphere-sounding project, participation with United Nations Committees on peaceful uses of outer space, and cooperation with a number of European countries in exchange of aeronautics and space developmental information are reported. Detailed accounts are included on activities in the space flight and advanced research programs. (J.R.D.)

14167 NP-8670
Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
COLOR CENTERS IN CESIUM HALIDE SINGLE CRYSTALS. Technical Report No. 149. Peter Avakian. Apr. 1960. 43p. Contract Nonr-1841(50).

Cesium chloride crystals were grown from solution with urea activator and from the melt using a double-run Bridgman method. The infrared absorption spectra of the solution-grown crystals showed about 0.01% NH_4^+ but no water contamination. Cesium bromide and CsI crystals were grown from the melt only. Coloration was produced by 130-kv x rays, 3.0-Mev electrons, and electrolysis. In CsI coloration resulted from electrolysis only. The absorption of uncolored and colored crystals was measured from 0.175 to 3.5 μ at 25, −78, and −190°C. All three crystals show one strong band in the visible (near infrared for CsI) and several weaker bands at shorter and longer wavelengths, which shift with temperature change. The spectral positions in mμ for a number of the bands at −190°C are tabulated for CsCl, CsBr, and CsI crystals. The strongest band (λ_6) behaved similarly to the F band in the NaCl-type alkali halides. The half-width of the band (0.20 to 0.23 ev at −190°C) and its increase with temperature, the shifting of the band maximum toward longer wavelengths upon warming to room temperature (by ~0.08 ev), and the conversion by bleaching with light into other bands support the assignment of this band as the F band. The spectral position of the band maximum approximately followed the Mollwo relation (λ_{max} = const d^n, where d = interionic distance and n = 2.5). Bleaching experiments suggested the assignment of the band λ_{10} as the M band and the bands between the F and M bands as R bands. The broad bands λ_3 which appear in irradiated crystals only are thought to be the V type. (auth)

14168 RM-2314(RAND)
RAND Corp., Santa Monica, Calif.
DAMAGE TO X-RAY DETECTORS BY METEORITES. Arthur A. Broyles. Jan. 21, 1959. 26p.

The effect of meteorites on a beryllium window covering an x-ray detector on a satellite was estimated using meteor density information from astronomical and satellite measurements. Bjork's formula for the depth of penetration of high-velocity particles striking a surface was employed to obtain a fraction of the order of 10^{-6} of the area of the window punched out by meteorites per year. Methods for reducing the amount of sunlight leaking through the holes to the photomultiplier tube are considered. Splitting the beryllium sheet into two parts appears to be a promising solution. (auth)

14169 SCTM-63-60(14)
Sandia Corp., Albuquerque, N. Mex.
DETERMINATION OF REQUIRED COMPONENT RELIABILITY FROM SYSTEM RELIABILITY REQUIREMENTS. A. M. Breipohl. Mar. 3, 1960. 71p. OTS.

A method for establishing component reliability requirements from system reliability specifications is given. Approximate methods were derived for determining the unique allocations of component catastrophic failure probability and the standard deviation of the component performance variables, each allocation resulting in a minimum cost for an assumed cost versus failure probability and standard deviation models, respectively. Approximate methods for each of the above allocations were derived without assuming specific cost models. (C.J.G.)

14170 AEC-tr-4014
FIELD DISTRIBUTION AND SPECIFIC BRAKING FORCE IN EDDY CURRENT BRAKES. Artur Grün. Translated for (Atomics International) from Arch. Elektrotech. 44, 131-45(1959). 34p. (Includes original, 14p.). JCL.

Magnetic excitation and magnetic field of eddy current brakes, the braking effect, and course of the field at standstill are discussed. Linking of the field equations to the boundary conditions at very low velocities and establishing of the field equations for the general case are considered. Constants are determined and the results are summarized. An example is given. (W.D.M.)

14171 AEC-tr-4041
STRENGTH OF A RAPIDLY ROTATING CYLINDER. M. Sh. Mikeladze. Translated from Priklad. Mat. i Mekhan. 16, 706-10(1952). 11p. JCL or LC.

Rotating cylinders are studied with respect to their strength under plastic and elastic conditions: (1) plastic condition of long, solid, incompressible cylinder, (2) plastic condition of hollow cylinder or drum, and (3) elastoplastic condition of cylinder, both solid and hollow. In (1), it is found that the problem of a purely elastic condition contains contradictions. For (2) and (3), tables of limit peripheral speeds are given for various values of radius ratios and strengths. (D.L.C.)

14172 AEC-tr-4047
THE NATURAL SYSTEM OF THE ELEMENTS (1 to 100). C. G. Bedreag. Translated from Acad. rep. populare Romîne, Filiala Iasi, Studii cercetări stiint. 3, 71-81(1952). 9p. JCL

Based on the fundamental Mendeleev principle, a table is presented showing in physical form the elements 1 to 100. Mendeleev's principle is discussed. The limits of nuclear stability of the elements 1 to 100 are discussed. (C.J.G.)

14173 AEC-tr-4048
INVESTIGATION OF HEAT EXCHANGE IN BOILING HOMOGENEOUS REACTOR. Ya. Malak and I. Schmid. Translated by Lydia Venters (Argonne National Lab.) from Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 9, 12-23(1959). 16p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4896.

14174 AEC-tr-4050
NEW INTERPRETATION OF THE DEPENDENCE OF LUMINESCENCE QUANTUM YIELD ON EXCITATION WAVELENGTH. V. L. Broude and V. S. Medvedev. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 129, 533(1959). 4p. JCL or LC.

The spectral distribution of the quantum yield of luminescence was determined for anthracene dissolved in (1) liquid styrene, (2) styrene after polymerization, and (3) prepared polystyrene. The curves for cases 1 and 3 show the approximate constancy of quantum yield. In case 2, the luminescence yield depends on the wavelength of excitation. During the copolymerization the molecules of anthracene penetrate into the chain of polystyrene and are retained. The nature of the forces retaining the anthracene molecule in the polymer chain is not explained. (C.J.G.)

14175 NP-tr-420
THE FLUORESCENCE EFFICIENCY OF SODIUM SALICYLATE IN THE U-V AND X-RAY REGION. Ernst Krokowski. Translated by M. H. Rand (U.K.A.E.A. Atomic Energy Research Establishment) from Naturwissenschaften 45, 509-10(1958). 5p. (Handwritten MS. copy). JCL.

The ratio of the energy of the fluorescence light to the energy of the exciting light absorbed in the luminescent material is called the energy efficiency A. A value of A of 0.04 was found for sodium salicylate. (W.L.H.)

14176 NP-tr-423
AN ASYMPTOTIC APPROXIMATION METHOD FOR A SYSTEM WITH ROTATING PHASES AND ITS APPLICATION TO THE MOTION OF A CHARGED PARTICLE IN A MAGNETIC FIELD. N. N. Bogolyubov and D. N. Zubarev. Translated by Burton D. Fried (Space Technology Labs., Inc.), from Ukraïn. Mat. Zhur. 7, 5-17(1955). 25p.

The motion of a charged particle in non-uniform electric and magnetic fields was investigated under the assumption that the magnetic field changes very little over the distance equal to one Larmor radius. In the first section the general case of a system of differential equations having a rapidly rotating phase is developed along with a method for separating the motion into a systematic motion to arbitrary order of approximation. In the second section the equations of motion of a charged particle in non-uniform electric and magnetic fields are put into a form which is convenient for the application of the method of asymptotic approximation and which explicitly contains a rapidly rotating phase. The last section shows how the above general method can be immediately applied to the case of interest, the motion of a charged particle in non-uniform electric and magnetic fields. As a result an equation for the average motion is obtained. (W.L.H.)

14177
RELATIVISTIC REACTION SYSTEMS AND THE ASYMMETRY OF TIME SCALES. K. L. Kowalski (Brown Univ., Providence). Am. J. Phys. 28, 487-91(1960) May.

As a simple illustration of the asymmetry of time scales between inertial and noninertial reference frames, a specific accelerated trajectory of a reaction system is calculated. A time dilatation resulting from the asymmetry is found to exist and to arise from contributions of the accelerated and constant velocity portions of the trajectory. (auth)

14178
PRESSURE-VOLUME-TEMPERATURE RELATIONS OF LIQUID He^3 FROM 1.00 TO 3.30°K. R. H. Sherman and F. J. Edeskuty (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.) 9, 522-47(1960) Apr.

Accurate P-V-T measurements were made for liquid He^3 at 0.98 to 3.32°K and from saturation pressure to the melting pressure. Included are measurements of the locus of the zero of the coefficient of expansion on the P-V-T surface and of the melting curve. Coefficients of expansion and compressibility have been deduced from the volume data and from these entropies of compression and heat capacities computed. Tables of all these quantities are included as well as properties of the saturated liquid. (auth)

14179

THE DETERMINATION OF A TANGENT TO THE TRAJECTORY OF A CHARGED PARTICLE. M. Huybrechts (Institut Interuniversitaire des Sciences Nucléaires, Brussels). Bull. classe sci., Acad. roy. Belg. (5) 45, 777-81(1959). (In French)

The method of probability maximum is applied to the determination of a tangent to the trajectory of a charged particle crossing a medium in which it leaves a visible track. (tr-auth)

14180

THE STUDY OF THE ELECTRON SPECTRA OF DIATOMIC OXIDES. I. SPECTRUM OF LaO. S. Hautecler and B. Rosen (Université, Liège). Bull. classe sci., Acad. roy. Belg. (5) 45, 790-803(1959). (In French)

The electron spectrum of LaO was studied in detail. The spectrum was excited in a carbon flame and photographed with a 6 m concave grating with a dispersion of 5 A/mm. The four band systems $A^2\pi \rightarrow X^2\Sigma$, $B^2\Sigma \rightarrow X^2\Sigma$, $C^2\pi \rightarrow X^2\Sigma$, and $D \rightarrow X^2\Sigma$ previously analyzed were restudied in detail and a new band sequence degraded toward the violet was also investigated. The results on the electron transitions of LaO are tabulated. Two transitions designated by E – ? and G – ? possibly form an electron doublet. If this is the case, the states below these transitions are placed approximately 1 ev below the normal $X^2\Sigma$ state of LaO. (J.S.R.)

14181

STUDY OF PARTICLES WITH LONG PATH FROM POLONIUM SOURCES. M. Morand, Y. Baudinet-Robinet, and L. Winand. Bull. soc. roy. sci., Liege 29, 28-36(1960) Jan.-Feb. (In French)

In photographic emulsions exposed to sources of Po, Th, Pu^{239}, Ra, and U, to active deposits of thoron and actinon, and to RaD sources, in addition to the known radiations, particle tracks with an abnormally long path, more than 300 microns, were found. The origin of these radiations with the long path was studied by the photographic method. Nuclear emulsions were exposed to natural Po sources of 1 and 5 mc. Approximately 4 long tracks per 100 tracks were found. Attempts at identification led to the conclusion that it is not impossible that the particles with long path are protons caused by the nuclear reaction of α particles from the Po with boron contained in the source. The long-path particles found in active deposits of thoron and actinon can be attributed to protons emitted during the reaction of α particles from the source with the nitrogen of the air. (J.S.R.)

14182

THE MAGNETIC LIGHTNING OF THE NUCLEAR TEST OF FEBRUARY 13, 1960, AT REGGANE. Jean Delloue. Compt. rend. 250, 2536-7(1960) Apr. 4. (In French)

An electromagnetic signal having its origin in the nuclear explosion of February 13, 1960, was recorded at a distance of 2500 km with a measured field attaining 0.1 v/m. (tr-auth)

14183

REVERSE PROBLEM IN THE ELECTROMAGNETIC PROBING THEORY. D. N. Chetaev (Inst. of Earth Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 12, 1864-6(1959) Dec. (In Russian)

An algorism, analogous to the Langer-Belluidgi algorism for probing in d-c current, was developed for analytical interpretations of results derived for electromagnetic probing of vertical magnetic-dipole excited fields. Calculations of geoelectric cross sections are reduced to a Koch problem solution of the infinite triangle type dynamic system. (R.V.J.)

14184

PHOTOGRAPHIC MATERIALS FOR THE DETECTION OF DEFECTS BY THE APPLICATION OF X-RAYS AND RADIATION OF ISOTOPES. A. Polster. Kep es Hangtech. 4, No. 3, 65-8(1958). (Translated from Referat. Zhur. Khim. No. 10, 1959, abstract No. 36254).

Photographic materials for the detection of defects with the aid of x rays and radiation of isotopes must have a high sensitivity to short-wave radiation and high radiographic indices. The increase of sensitivity to short-wave radiation is achieved by sensitizing the emulsion by the use of complex salts of gold. The high x-ray indices are produced by technological conditions of the emulsion preparations, which guarantee size uniformity of the silver halide grains and a high contrast coefficient.

14185

ON THE CAPACITY OF A SPHERE INSIDE A CUBE. F. W. de Wette (Univ. of Utrecht). Koninkl. Ned. Akad. Wetenschap., Proc. Ser. B, 63, 108-12(1960).

A condenser consisting of a conducting sphere placed concentrically inside a conducting cube is considered. A rapidly converging expression for its capacity C is derived with the aid of a method developed elsewhere for the description of electrostatic fields in ionic crystals. Two approximations for C are discussed. (auth)

14186

ELECTRONIC STRUCTURE OF LiH. V. A RADIALLY CORRELATED WAVE FUNCTION. J. M. Robinson (Texas Coll. of Arts and Industries, Kingsville) and J. D. Stuart and F. A. Matsen (Univ. of Texas, Austin). J. Chem. Phys. 32, 988-91(1960) Apr.

The electronic energy and dipole moment of LiH are calculated with valence-bond wave functions into which some radial correlation has been introduced by assigning different orbitals to different electrons. The energy calculated from the radially correlated functions is 0.76 ev lower than that from the uncorrelated functions. The calculated dipole moment agrees well with that obtained in previous calculations. Moffitt's concept of "atoms in molecules" is applied to the correlated and uncorrelated functions. (auth)

14187

ELECTRICAL PROPERTIES OF ORGANIC SOLIDS. I. KINETICS AND MECHANISM OF CONDUCTIVITY OF METAL-FREE PHTHALOCYANINE. Gordon Tollin, David R. Kearns, and Melvin Calvin (Univ. of California, Berkeley). J. Chem. Phys. 32, 1013-19(1960) Apr.

High-intensity, short-duration light pulses were used in the study of photoconductivity kinetics in films of metal-free phthalocyanine. These experiments, in conjunction with those of steady-state photoconductivity, are consistent with the following scheme: the principal route for the formation of charge carriers is via the first excited singlet state, although the lowest triplet state can, to some extent, contribute; the mobility of the carriers is low and is inversely proportional to the carrier concentration; and the decay of the photocurrent is the result of a diffusion-limited bimolecular recombination, with a capture radius of approximately one molecular diameter. The experiments indicate that carriers produced thermally in the dark do not interact with light-produced carriers. (auth)

14188

ELECTRICAL PROPERTIES OF ORGANIC SOLIDS. II. EFFECTS OF ADDED ELECTRON ACCEPTOR ON METAL-FREE PHTHALOCYANINE. David R. Kearns, Gordon Tollin, and Melvin Calvin (Univ. of California, Berkeley). J. Chem. Phys. 32, 1020-5(1960) Apr.

The addition of ortho-chloranil to the surface of films of metal-free phthalocyanine was found to increase the dark conductivity of such films by as much as 10^7, to increase the steady-state photoconductivity by as much as 10^5, and to result in the formation of unpaired electrons whose concentration decreases reversibly with illumination. These systems exhibit a light-induced polarization, the phthalocyanine layer becoming more positive with respect to the ortho-chloranil layer. Upon illumination, a single process (time constant = 60 sec) results in the increase in conductivity, the decrease in unpaired spins and the increase in polarization. The results are consistent with the following scheme: an electron transfer from phthalocyanine to ortho-chloranil occurs in the dark; illumination results in the transfer of another electron from an excited phthalocyanine molecule to the ortho-chloranil negative ion producing more phthalocyanine holes. By equating spin concentration with charge carrier concentration (phthalocyanine holes) a mobility of 10^{-4} cm^2/v/sec is calculated for holes in the phthalocyanine layer. With this value, a quantum yield of unity is calculated for the production of charge carriers in doped phthalocyanine, and less than 10^{-1} for undoped phthalocyanine. The over-all results of adding a strong electron acceptor to a film of phthalocyanine are thus to (a) produce charge carriers in the dark, (b) increase the quantum yield for production of charge carriers by light and (c) increase charge carrier lifetime. (auth)

14189

EFFECT OF DEUTERIUM SUBSTITUTION ON THE LIFETIME OF THE PHOSPHORESCENT TRIPLET STATE OF NAPHTHALENE. Clyde A. Hutchison, Jr. and Billy W. Mangum (Univ. of Chicago). J. Chem. Phys. 32, 1261-2 (1960) Apr.

Deuterated naphthalene in deuterated durene (DD) was observed to have an extraordinarily intense paramagnetic resonance signal relative to ordinary naphthalene in ordinary durene (HH). Decays of the magnetic resonances after cessation of ultraviolet irradiation were examined at 77°K and found to obey an exponential decay law with a mean life of 2.1 ± 0.1 sec for HH and 16.9 ± 0.7 sec for DD. The mean life of ordinary naphthalene in deuterated durene (HD) was examined and found to differ by less than 0.5 sec from that of HH. The resonance decay was also studied with the static magnetic field along two of the principal magnetic axes of HH and along all three axes of DD. The variation of lifetime with direction was nil, showing that the change of lifetime is purely a mass effect rather than a nuclear hyperfine effect. (D.L.C.)

14190

SIMILITUDE AND ANODE MATERIAL EFFECTS IN H_2 AND D_2 DISCHARGES BELOW THE CRITICAL PRESSURE. Gordon W. McClure (Sandia Corp., Albuquerque, N. Mex.). J. Electronics and Control (1) 7, 439-47(1959) Nov.

The breakdown potentials of H_2 and D_2 gases were determined below the critical pressure in two discharge tubes of similar shape but of different size in order to ascertain whether or not the initial breakdown conditions conform to Paschen's similarity law. With stainless steel anodes and cathodes, both gases conform extremely well to Paschen's law over a range of pressures yielding starting potentials from 0.3 to 10 kv. With the same cathodes but with anodes of Pb and Al, small deviations from similarity were observed. It is possible that these deviations are not fundamental, but resulted from deposition of anode material onto the cathode. The present results confirm earlier evidence of a strong dependence of breakdown potential on anode material which occurs only at very low pressure. (auth)

14191

POLARIZATION OF LUMINESCENCE IN ZnS AND CdS SINGLE CRYSTALS. A. Lempicki (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). J. Electrochem. Soc. 107, 404-9(1960) May.

The fluorescent emission from hexagonal ZnS and CdS single crystals is found to be polarized preferentially perpendicular to the c axis for both polarized and unpolarized excitation. Cubic ZnS crystals emit unpolarized radiation. The results are analyzed in terms of a simple dipole theory which is shown to be inadequate for the description of luminescent centers in these materials. Preliminary observations on the polarization of fluorescence of ZnO crystals are reported. (auth)

14192

POLARIZATION OF FLUORESCENCE IN CdS AND ZnS SINGLE CRYSTALS. Joseph L. Birman (General Telephone and Electronics Research Labs., Inc., Bayside, N. Y.). J. Electrochem. Soc. 107, 409-17(1960) May.

The polarization of fluorescence in hexagonal (wurtzite) crystals of CdS and ZnS gives a clue to the symmetry of the states between which the luminescent transition occurred. Unfortunately this clue is at present equivocal; there are many models for the center which would be consistent with the observed polarization. Various symmetry properties of the wurtzite structure and the band structure of CdS and ZnS at k = 000 are discussed. These symmetry and band structure considerations are used to set up and consider various models, Lambe-Klick, Schoen-Klasens, etc., which would be in accord with observation of polarization. It is concluded that the Lambe-Klick model is the simplest which is in accord with the available observations. Some experimental tests are proposed which should help the decision among the various models. In conjunction with other single crystal optical, electrical, and magnetic measurements, polarization studies may prove decisive in obtaining quantitative knowledge about the centers in sulfides. (auth)

14193

EFFECT OF CdS ADDITION IN ZnS: Cu,In AND ZnS: Ag,In PHOSPHORS. Eugene F. Apple (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 107, 418-22(1960) May.

ZnS: Cu,In and ZnS: Ag,In phosphors each can show two emission bands under 3650Å excitation, namely, in the green and orange with Cu and in the blue and yellow with Ag activator. Addition of CdS causes the ratio of intensities of the short to long wave-length emission to increase. This observation is interpreted using the donor-acceptor associated pair model proposed recently for the long wave-length emission process. (auth)

14194

GROWTH AND HEAT TREATMENT OF ZINC SULFIDE SINGLE CRYSTALS. A. Kremheller (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). J. Electrochem. Soc. 107, 422-7(1960) May.

Zinc sulfide crystals grow readily from the vapor phase if small traces of certain impurities, such as zinc oxide and copper, are present. The decrease of ambient impurity concentration leads first to very thin, flexible, ribbon-like crystals which are hexagonal, and finally to nucleation with little growth. The purity of crystals depends not only on the composition of the starting material but also on the purity of the combustion tube employed; contamination during growth leads to an impurity gradient in crystals and to impurity variations among crystals. Crystals usually exhibit disorder of the crystal structure, although pure cubic or hexagonal structure can be achieved by annealing or quenching. Heat treatment also changes the impurity content and attendant properties, such as physical color, luminescence behavior, electrical properties, and disorder of the crystal structure. (auth)

14195

SPECTRAL STUDY OF THE LUMINESCENCE FROM EXCITATION OF RARE GASES BY α RAYS. Lydie Koch (Centre d'Études Nucléaires, Saclay, France). J. phys. radium 21, 169-73(1960) Mar. (In French)

Luminescence spectra of the noble gases He, Ar, and Xe are studied under excitation by α rays. It is shown that the energy is transferred from excited levels of these gases to Hg and N_2 impurities for impurity concentrations, respectively, less than 10^{-6} and 10^{-4}. These results confirm previous measurements concerning the period of luminescence and its variations versus nitrogen concentration in noble gases. (auth)

14196

BREAKDOWN OF ARGON AT LOW PRESSURE IN A LONGITUDINAL MAGNETIC FIELD. Kenji Mitani and Hiroshi Kubo (Kyoto Univ.). J. Phys. Soc. Japan 15, 678-84(1960) Apr. (In English)

The breakdown probability at low pressure in argon was measured with 0 to 1,500 gauss magnetic fields parallel to the electric field. With the overvoltage fixed at 16.5%, the number of breakdowns was counted for applied square pulses. The breakdown probability increases with magnetic field intensity. The breakdown probability was calculated on the assumptions that breakdown was caused by multi-avalanche, and that the secondary mechanism was due to the drift of resonance radiation in the diffusion process as Kachikas and Fisher suggested. A fairly good agreement between theory and experiment was attained and the drift velocity of resonance radiation was about 9.5×10^5 cm sec^{-1} in the calculation. (auth)

14197

ANGULAR DEPENDENCIES OF EFFICIENCIES FOR SODIUM—IODIDE CRYSTALS. Tadayoshi Doke, Atsushi Nakamoto, Yasukiyo Takami, and Manabu Hattori (Rikkyo Univ., Tokyo) and Shinji Okano (Inst. of Physical and Chemical Research, Tokyo). J. Phys. Soc. Japan 15, 737-8(1960) Apr. (In English)

Detection efficiencies for NaI crystals are calculated as a function of the direction of the incident parallel gamma rays, assuming that the crystal consists of slices and that the probability of photon-crystal interaction is proportional to $1 - \exp[-\mu(E)l]$, where $\mu(E)$ is the total absorption cross section for the photon. The efficiencies are computed between 0 and 90° for the energy range 0.1 to 2 Mev and are plotted vs. the angle. It is concluded that the variation of the peak efficiency with direction is nearly equivalent to variation of the total detection efficiency. (D.L.C.)

14198

A CARBON-14 BETA-RAY STANDARD, BENZOIC ACID-7-C^{14} IN TOLUENE, FOR LIQUID SCINTILLATION COUNTERS. W. F. Marlow and R. W. Medlock. J. Research Natl. Bur. Standards 64A, 143-6(1960) Mar.-Apr.

A carbon-14 beta-ray standard for use in liquid scintillation counting was prepared and standardized. The sample consists of benzoic acid-7-C^{14} dissolved in toluene. Samples of the solution were oxidized quantitatively in a Paar oxygen bomb, and the radioactivity of the carbon dioxide was compared with the radioactivity of carbon dioxide prepared quantitatively from the Bureau's sodium carbonate-C^{14} standard. (auth)

14199

A GENERAL FORMULA FOR THE CALCULATION OF ATOMIC PHOTO-IONIZATION CROSS SECTIONS. A. Burgess and M. F. Seaton (University Coll., London). Monthly Notices Roy. Astron. Soc. 120, 121-51(1960).

The general formula is derived by considering the model of a single electron moving in a central field. Approximate bound-state radial functions, accurate for large radial distances, may be obtained once the effective quantum numbers $\nu(=n^*)$ are known. Such functions may be used to obtain good estimates for bound-bound transition integrals. For bound-free transitions use is made of approximate free-state radial functions having exact asymptotic forms, their phases being given by $\delta = \pi\mu$ where μ is the extrapolated quantum defect $(\mu = n-\nu)$. The results of extensive numerical calculations are summarized in tables which permit the rapid calculation of transition integrals once the energy levels are known. Both bound-free and bound-bound transition integrals may be obtained. For bound-bound transitions $\nu \rightarrow \nu'$ good agreement is obtained with the Bates and Damgaard tables for $|\nu-\nu'| \geq 1.5$. Comparisons are made with other results for bound-free transitions, as obtained both from theory and from experiment. In nearly all cases the general formula gives results at least as accurate as those obtained in the best alternative methods of calculation. (auth)

14200

SHOCK HUGONIOTS FOR LIQUID ARGON. W. Fickett and W. W. Wood (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 3, 204-9(1960) Mar.-Apr.

Shock Hugoniots for liquid argon are calculated using equations-of-state obtained from the Monte Carlo method and the Lennard-Jones-Devonshire cell theory, using an experimentally determined pair potential. Agreement with presently available experimental data is poor. (auth)

14201

DIAGRAM EXPANSIONS IN QUANTUM STATISTICS. Howard B. Levine (Univ. of California, Livermore). Phys. Fluids 3, 225-45(1960) Mar.-Apr.

The Montroll-Ward-Lee-Yang approach to quantum statistics is generalized to multicomponent systems. It is generalized so as to include external fields. The formalism is constructed in a volume-dependent manner, and includes internal coordinates, such as spin, from the beginning. It is rigorously proved that the quantum-mechanical volume-dependent cluster integral may be expressed in terms of connected diagrams only. The rules for drawing these diagrams are given. By simply generalizing the meaning of the word "determinant," all arguments are made to apply to both Fermi-Dirac and Bose-Einstein statistics simultaneously. A statistics factor, $\gamma = \pm 1$, for bosons (fermions) is introduced, in terms of which single formulas apply to both statistics. Rules are stated, by means of which the γ dependence of the contribution to the pressure for any diagram is given in terms of an elementary topological property of the diagram. (auth)

14202

NUCLEAR SPIN RELAXATION IN LIQUID He^3. [PART] II. R. H. Romer (Duke Univ., Durham, N. C.) Phys. Rev. 117, 1183-7(1960) Mar. 1.

The nuclear spin thermal relaxation time, T_1, of He^3 nuclei in pure liquid He^3 at its saturated vapor pressure was measured between 0.8 and 3.1°K, at static magnetic fields from 1560 gauss to 12,200 gauss. No dependence of T_1 on the static magnetic field was observed. The measured relaxation times increase gradually from 300 seconds at 0.8°K to 650 seconds at 3.1°K. These times do not appear to have been significantly shortened by wall relaxation processes. These results, which do not agree with earlier measurements, are in fair agreement with the short correlation time form of the Bloembergen, Purcell, and Pound theory of spin relaxation in liquids. (auth)

14203

MAGNETISM OF INTERACTING DONORS. E. Sonder and H. C. Schweinler (Oak Ridge National Lab., Tenn.). Phys. Rev. 117, 1216-21(1960) Mar. 1.

The magnetic susceptibility of donor centers in semiconductors is calculated for the case of small interactions between closely adjacent donors. A hydrogenic model is assumed for the donor centers. The random distribution of the centers, and the variation of the energy of interaction with separation distance of pairs of donors is taken into consideration. A twofold modification of the Curie law (which is correct for independent donors) is predicted by the resulting expression, namely, a curvature as well as a decrease of the slope of the Curie plot of the susceptibility versus inverse temperature. Both of these effects increase with the donor density, becoming appreciable in silicon with $10^{17}-10^{18}$ donors/cm^3 and in germanium in the range around 10^{16} donors/cm^3. The theory is in good agreement with measurements. (auth)

14204

STRONG-COUPLING LIMIT IN THE THEORY OF SUPERCONDUCTIVITY. D. J. Thouless (Univ. of California, Berkeley). Phys. Rev. 117, 1256-60(1960) Mar. 1.

The hamiltonian used by Bardeen, Cooper, and Schrieffer (BCS) in their theory of superconductivity is studied in the strong-coupling limit. The complete set of energy levels can be found by using group theory, even for a finite system. An expression for the grand partition function can be evaluated in a simple manner for a large system. The results are in qualitative agreement with the weak-coupling theory and in quantitative agreement with the strong-coupling limit of the BCS expressions. The second-order phase transition is a simple consequence of the form of the grand partition function. There is an energy gap independent of the total number of particles which goes to zero as the temperature approaches the critical temperature. The normal state is not metastable below the critical temperature. (auth)

14205

DRIFT VELOCITY OF ELECTRONS IN NITROGEN, HELIUM, NEON, ARGON, KRYPTON, AND XENON. J. C. Bowe (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 1411-15(1960) Mar. 15.

Accurate values of electron drift-velocity in purified noble gases and nitrogen were obtained by measuring the transit time of photoelectrons across the gap of a parallel-plate condenser. Drift velocities in pure krypton and xenon have not been measured before. The values obtained for the other gases are invariably lower than those reported by Nielsen, the discrepancy for neon being large. The sharp maximum found by English and Hanna for argon at $E/\rho_0 < 0.1$ and tentatively ascribed by them to the Ramsauer effect was not observed in the purified gas. (auth)

14206

TRANSPORT COLLISION CROSS SECTIONS FROM ELECTRON DRIFT-VELOCITY DATA. J. C. Bowe (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 1416-20 (1960) Mar. 15.

Information concerning the transport collision cross section $\sigma_t(\epsilon)$ of low-energy electrons in the noble gases was obtained from drift-velocity data. The results (with ϵ in ev) are He: $\sigma_t(\epsilon) = (28 \pm 1)\ cm^{-1}$ for $0.13 \leq \epsilon \leq 4$; Ne: $\sigma_t(\epsilon) = (6.05)\epsilon^{0.157}\ cm^{-1}$ for $0.38 \leq \epsilon \leq 8$; A: $\sigma_t(\epsilon) = (6.3 \pm 0.6)\epsilon\ cm^{-1}$ for $1.6 \leq \epsilon \leq 11$; Kr: $\sigma_t(\epsilon) = 14\epsilon\ cm^{-1}$ for $1.6 \leq \epsilon \leq 3$; Xe: $\sigma_t(\epsilon) = 26\epsilon\ cm^{-1}$ for $1 \leq \epsilon \leq 2.4$. All σ_t values are for 0°C and 1 mm Hg pressure. These results are compared with other experimental and theoretical data. For nitrogen the drift-velocity measurements indicate an average fractional energy loss per collision of $20(2m/M)$ in the energy range $\epsilon = 0.07$ to 0.15 ev. (auth)

14207

STATISTICAL POTENTIAL FOR ACTINIDE METAL ENERGY BAND CALCULATIONS. Guy W. Lehman (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Phys. Rev. 117, 1493-6(1960) Mar. 15.

A simple analytic potential energy function, V, is developed from a Thomas-Fermi ion model for the actinide metals and is found to provide good agreement with wave functions derived from the Hartree self-consistent field approach by Ridley for the 5f, 6d, and 7s states of uranium. The estimated 5f, 6d, and 7s bandwidths are 1.1, 7.3, and 11.8 ev, respectively, in satisfactory agreement with those of Ridley. Dirac's equations are solved for the 5f, 6d, and 7s states using this nonrelativistic potential energy function with the Wigner-Seitz boundary condition. The relativistic energy shift for the 7s state is roughly 13 ev. (auth)

14208

GENERALIZATION OF THE APPLETON-HARTREE MAGNETO-IONIC FORMULA. H. K. Sen and A. A. Wyller (Air Force Cambridge Research Center, Bedford, Mass.). Phys. Rev. Letters 4, 355-7(1960) Apr. 1.

A generalization of the Appleton-Hartree magneto-ionic formula is given. This generalization parallels the work of Jancel and Kahan, but the resultant expressions are formally simpler. As in the method of Jancel and Kahan, the Chapman-Enskog method of solving the Boltzmann transport equation is used. (C.J.G.)

14209

PHOTON MOMENTUM EFFECTS IN THE MAGNETO-OPTICS OF EXCITONS. J. J. Hopfield and D. G. Thomas (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 4, 357-9(1960) Apr. 1.

Two pronounced magneto-optic effects (on excitons) due to the finite wave vector of light are described. The first effect is the drastic alteration of the magneto-optic absorption spectrum when the magnetic field is reversed. The second effect arises from the quasi-electric field $(1/c)\vec{V} \times \vec{H}$ due to the motion of the exciton in a uniform magnetic field. Only the first effect was positively identified in CdS crystal at 1.6°K. (C.J.G.)

14210

EXCITATION OF ROTONS IN HELIUM II BY "COLD" NEUTRONS. Bronislaw Buras (Univ. of Warsaw and Nuclear Research Inst., Polish Academy of Sciences, Warsaw). Postępy Fiz. 9, 189-96(1958) Mar.-Apr. (In Polish)

The properties of helium at low temperatures, notably the inelastic dispersion of "cold" neutrons in He II and the excitation of rotons, are treated. The theories of M. Cohen and R. P. Feynman are discussed, and the corroborating experiment of H. Palevsky, K. Otnes, K. E. Larsson, R. Pauli, and R. Stedman is described. Plots of neutron scattering are included. (JPRS)

14211

EXTERNAL DAMPING, MUTUAL INTERACTION OF ACTIVATORS, AND MIGRATION OF HOLES IN THE PHOSPHORS ZnS—Cu and ZnS—Cu,Co. M. W. Fock (Lebedev Inst. of Physics, Academy of Sciences, USSR). Postępy Fiz. 9, 197-209(1958) Mar.-Apr. (In Polish)

The recombination interaction of the centers of blue and green luminescence and the damping of the phosphors of ZnS-Cu and ZnS-Cu,Co with infrared radiation were the subject of an experimental study. The analysis of the recombination interaction was based on a scheme analogous to that proposed by W. A. Jastrebow in 1941 [See W. A. Jastrebow, Trudy FIAN. 3, No. 2, 121(1946)]. Phosphors prepared from non-activated ZnS in an HCl atmosphere at a temperature of 1150°C were studied. The copper content in the phosphor was 10^{-7} g/g. It showed a strong blue luminescence. At high temperatures the green luminescence grows stronger than the blue, with an increase in intensity of the excitation light. A certain divergence from theoretical computations developed, i.e., computations show that the luminescence intensity of phosphors under the influence of temperature for one of the lines (green or blue) can only be non-linear when it is linear for the other, while the experiment has shown the existence of a region where this dependence is non-linear for both. This fact is probably associated with the appearance of external damping. Studies made of the damping of both luminescence lines excited by $\lambda = 436$ mμ radiation show that the drop of blue luminosity of ZnS-Cu(10^{-6}) is almost the same as the green. It was confirmed experimentally that light with wave length $\lambda = 436$ mμ does not excite directly the blue centers. Thus, phosphors containing no copper exhibit a strong blue luminescence (more intense than phosphors containing copper) under the action of ultraviolet ($\lambda = 366$ mμ), but radiation of $\lambda = 436$ mμ does not produce this luminescence. Damping of ZnS-Cu,Co by infrared radiation apparently results in the liberation of holes from ionized centers. This external damping proceeds in accordance with a reaction of the second order and there is no reaction of the first order. (JPRS)

14212

SOME OPTICAL PROPERTIES OF NEW LUMINOPHORS ACTIVATED BY ELEMENTS OF THE RARE EARTH GROUP. Z. A. Trapeznikova (Lebedev Inst. of Physics, Academy of Sciences, USSR). Postępy Fiz. 9, 211-20 (1958) Mar.-Apr. (In Polish)

Observation of luminophors activated by Nd, Pr, Sm, Dy, Eu, and Tm shows the appearance of absorptions of a linear character in the visible spectrum. By the application of radiation with a wave length corresponding to these lines a weak luminescence was induced (also of a linear type) in ZnS-Er at room and low temperatures and in ZnS-Dy and ZnS at liquid nitrogen temperature. The strong luminescence of luminophors activated by lanthanides is not connected with any absorption of light by these activators. The influence of oxygen on the luminescence and excitation spectra of Zn-Sm was observed in the spectrum of ZnS and Sm (1.9×10^{-4} g-atom Sm/mol ZnS) dried at 300°C in a stream of N purified of oxygen and then heated in a stream of N at 1150°C. The ZnS-Sm luminescence spectrum produced by radiation of wave length $\lambda = 365$ mμ consists of three lines: red, orange, and green; red is most intense. Introduction of ZnO causes the appearance of an additional wide green strip. It is concluded that with ZnO introduction (2.4×10^{-2} mole ZnO/mole ZnS) the number of primary centers of luminescence in which the Sm ion was surrounded by S ions decreases and the number of centers where O replaced S increases. Introduction of other anions, such as selenium, to ZnS also causes changes in the luminescence spectrum. (JPRS)

14213

KINETICS OF PHOTOELECTRIC PROCESSES IN SEMICONDUCTORS. V. A. Romanov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ėkspt. No. 6, 70-4 (1959) Nov.-Dec. (In Russian)

A device with sinusoidal light modulation by a Kerr cell was used in measuring the kinetics of photoconductivity, volume photoelectromotive force, and photomagnetic electromotive force in semiconductors in a wide range of frequencies (20 Hz to 1.5 MH_2). A method was developed for eliminating interference from the Kerr cell at frequencies >100 kHz. (tr-auth)

14214

THE THEORY OF ION-ELECTRON EMISSION FROM METALS. [PART] II. S. V. Izmailov (Gertsen State Pedagogical Inst., Leningrad). Soviet Phys.-Solid State 1, 1415-24(1960) Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3186.

14215

THE THEORY OF SECONDARY ELECTRON EMISSION FROM METALS UNDER THE ACTION OF FAST NEUTRAL ATOMS. [PART] III. S. V. Izmailov (Gertsen State Pedagogical Inst., Leningrad). Soviet Phys.-Solid State 1, 1425-8(1960) Apr.

The mechanism of kinetic emission of electrons from metals by the action of fast neutral atoms is discussed. As in the case of ion-electron emission, it is assumed that emission is due to retardation quasi-quanta. It is shown that, for not very high atom energies, the coefficient of secondary atom-electron emission is proportional to the square of the incident atom velocity and for $\tau\Phi \gg \hbar$ agrees in order of magnitude with the coefficient of ion-electron emission. (auth)

14216

FUNDAMENTAL STUDY OF THE ATOMIC BATTERY. Chiyoe Yamanaka, Hiroshi Wada, and Yutaka Yamamura. Technol. Repts. Osaka Univ. 8, 233-41(1958) Oct. (In English)

Electron-voltaic effects in diffused p-n junctions of Ge were obtained by diffusing As at 210°C in 10^{-5} Hg vacuum on a p-type Ge, doped with In, of 3 Ω/cm resistivity. A thin Au wire was attached to the surface of this junction by soldering. The p-n junction was irradiated with a 50-mc Sr^{90}–Y^{90} source, and the electron-voltaic effect was measured from room temperature down to −78°C. The general condition of an atomic battery was similar to that of a solar battery except that the atomic battery offers the possibility of current multiplication but presents the problem of radiation damage in the crystal lattice. At room temperature no radiation damage was observed. The junction and radiation damage of a Si-based atomic battery was also studied. (OID)

14217

ANALYTICAL FUNCTION OF HELIUM TYPE ATOMS IN GROUND STATE. T. S. Skvortsov, V. K. Shugurov, and K. K. Eringis (Inst. of Physics and Mathematics, Academy of Sciences, Lithuanian SSR). Trudy Akad. Nauk Litovskoi S.S.R., Ser. B. No. 4, 27-9(1959). (In Russian)

It is shown that each single-electron function of the helium-type atom ground state is characterized by its parameter. The derived functions are used for calculating the energy of the neutral helium atom and three helium-like ions in the ground state. (R.V.J.)

14218

LINEARIZED PROBLEM ON STRONG EXPLOSION PROPAGATION IN HETEROGENEOUS ATMOSPHERE. V. P. Karlikov. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 4, 27-39(1959). (In Russian)

The linear solution for the problem of a strong point explosion in a medium with initial density varying in space according to various laws was developed and plotted considering the previously resolved zero approximation automodel solution. In addition to the automodel problem, which took into account the influence counter pressure and considered the density of the medium as constant, the linear problem takes into account the influence rarefied density and covers other conditions not considered in the automodel method. (R.V.J.)

14219

ON MAXIMUM CROSS SECTION IN NONRESONANT CHARGE EXCHANGE. N. V. Fedorenko and V. A. Belyaev (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1808-9(1959) Dec. (In Russian)

The factors affecting the inelastic cross section (σ_{max}) in nonresonant single-electron charge exchange were studied. Charge exchange cross sections are strongly influenced by the structures of external electron shells of ion (I^+) and targets (A). Data were obtained which reveal the absolute magnitude (ΔE) of the resonance defect and the influence of the target index number (N) on the magnitude of the σ_{max}. The σ_{max} increases with the increase of N and decreases with the increase of (ΔE). Two characteristic cases were observed for the same ion with different target atoms: with steadily increasing (ΔE) and decreasing N, σ_{max} sharply decreases because both factors act in the same direction; with simultaneously increasing (ΔE) and N, with both factors acting in the opposite direction, σ_{max} slowly increases. Data on σ_{max} (ΔE) as a function of single-electron exchange for C^+ and He^+ in inert gases are plotted. (R.V.J.)

14220

ON THE SOLID HYDROGEN STRUCTURE. A. A. Galkin and I. V. Matyash (Inst. of Radiophysics and Electronics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1831-2(1959) Dec. (In Russian)

Nuclear magnetic resonance of cylindrical hydrogen mono- and polycrystalline specimens prepared with various temperature gradient directions to the axis was studied at 4.2°K. The diagram of monocrystals, rotating around the axis perpendicular to the constant magnetic field vector, showed the absence of noticeable (over 2%) second nuclear magnetic resonance anisotropy. The width and shape of monocrystalline specimens coincided with those of the polycrystalline ones. A certain nuclear magnetic resonance anisotropy may be found at the temperatures below 1.5°K, at which the molecule rotation is slowed and fine line structure appears. (R.V.J.)

14221

CAPTURE AND LOSS OF ELECTRON IN COLLISIONS OF FAST HELIUM, BORON AND FLUORINE ATOMS WITH GAS MOLECULES. Ya. M. Fogel, V. A. Ankudinov, and D. V. Pilipenko. Zhur. Eksptl'. i Teoret. Fiz. 38, 26-32 (1960) Jan. (In Russian)

Results are given from measurements of the cross sections σ_{0-1} and σ_{01} of electron capture and loss by fast He, B, and F atoms with 10 to 60 kev energies in collisions with inert gas atoms. It is shown that the shape of σ_{0-1} (v) curves and the position of their maxima can be explained in terms of the Massey adiabatic hypothesis. In the case of He atoms the shape of the curve is affected by admixture of metastable He atoms in the primary beam. The adiabatic hypothesis cannot be applied to electron loss by fast atoms. (auth)

14222

ON THE AUTO-OSCILLATIONS OF CHARGE IN CROSSED FIELDS. Yu. N. Barabanenkov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 263(1960) Jan. (In Russian)

The motion of a charge in mutually perpendicular, uniform electric and magnetic fields was analyzed assuming that the charge is acted upon by a friction force. (R.V.J.)

13223

ON THE POSSIBLE UTILIZATION OF γ RAY RESONANCE SCATTERING. I. Ya. Barit, M. I. Podgoretskiĭ, and F. L. Shapiro (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 301-2(1960) Jan. (In Russian)

Experiments were made with Ir^{191} γ rays of 129 kev. Excitation time was $\sim 10^{-10}$ sec, corresponding to a width $\Gamma = 10^{-5}$ ev and relative width $\sim 10^{-10}$. The Doppler effect appears at velocity ~1 cm/sec. An attempt was made to utilize the resonance absorption for investigations of various displacements and spallations of nuclear levels. Of these, the transverse Doppler effect, the Zeeman nuclear effect, and the displacement of gravitational field as predicted by general relativity theory are indicated as examples. The first two effects are possible with displacement orders of 10^{-7} to 10^{-8} ev, while the displacement of the gravitational field, with the quantum energy of 100 kev corresponds to absolute displacement $\sim 10^{-10}$ ev. Among the stable nuclei studied, Zn^{67} was found to have a 92-kev level ($\tau = 9.3 \times 10^{-6}$ sec) excited in K capture by Ga^{67} (half life 78 hour) with relative width $\Gamma/E \sim 10^{-15}$ which was used for studying the gravitation effect. (R.V.J.)

14224

ELECTRON RELAXATION TIME IN A HIGH FREQUENCY ELECTROMAGNETIC FIELD AND THE SURFACE IMPEDANCE OF A METAL. R. N. Gurzhi and M. Ya. Azbel. Zhur. Eksptl'. i Teoret. Fiz. 38, 524-28(1960) Feb. (In Russian)

The effect of quantization of the electromagnetic field and electron orbits in a constant magnetic field on the relaxation time of electrons in a metal due to electron-phonon interactions and on the surface impedance of the metal was studied. The complete frequency region (normal skin effect, anomalous skin effect, and infrared region) up to the internal photoeffect limit was investigated. It is shown that quantization of the orbits is significant only in the anomalous skin effect region for $\omega \sim \Omega \gtrsim kT/\hbar$ (Ω is the cyclotron frequency, and T is the temperature). Quantization of the electromagnetic field is shown to be important in the infrared region and for the anomalous skin effect in a constant magnetic field (throughout the whole magnetic field region for $\omega \sim \Omega$ and only for cyclotron resonance when $\omega \gg \Omega$). (auth)

14225

PLASTIC SCINTILLATORS ON A POLYSTYRENE BASIS. [PART] III. E. E. Baroni, K. A Kovyrzina, I. M. Rozman, E. E. Andreeshchev, and V. M. Shoniya. Zhur. Fiz. Khim. 34, 665-7(1960) Mar. (In Russian)

New organic additions are described for the preparation of highly efficient plastic scintillators suitable for recording ionizing radiation. (auth)

14226

MULTIPLY CHARGED ION SCATTERING CONNECTED WITH CAPTURE OF ELECTRONS. N. V. Fedorenko, L. G. Filippenko, and I. P. Flax (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 30, 49-56(1960) Jan. (In Russian)

Angular distributions in single scattering of fast ions and atoms formed during charge exchange by Ne^{2+}, Kr^{2+}, Kr^{3+}, and Kr^{+} at 33 kev in neon and krypton were investigated. It was found that electron capture processes are accomplished at small scattering angles. Measurements were made of differential scattering cross sections with partial primary ion neutralization, of scattering without any neutralization of angles $0.5° \leq \theta \leq 2.5°$, and scattering with total neutralization. Total neutralization scattering was studied for relatively narrower angles of distribution than those with partial neutralization. In both cases the angular distributions expand with an increasing number of captured electrons. The total differential scattering cross sections were calculated, and the convergence of particles in the capturing process was evaluated. The calculations indicate that electron capture processes take place at distances of the order of atomic dimensions or larger. (tr-auth)

14227

POSITIVE KORPUSKULARSTRAHLEN. (Positive Particle Rays). [TEIL] A. VERHALTEN VON ALPHA-STRAHLEN BEIM DURCHGANG DURCH MATERIE. ([Part] A. Behavior of Alpha Rays in Passage through Matter). H. Pose. [TEIL] B. KANALSTRAHLEN UND IHRE WECHSELWIRKUNG MIT MATERIE (EINSCHLIESSLICH MASSENSPEKTROSKOPIE). ([Part] B. Canal Rays and their Interactions with Matter (Including Mass Spectroscopy)). R. Wierl. Hand- und Jahrbuch der Chemischen Physik. Band 6. Abschnitt III. A. Eucken and K. L. Wolf, eds. Leipzig, Akademische Verlagsgesellschaft m.b.H., 1933. 293p.

A two-part presentation is made. Part one entitled "Behavior of Alpha Rays in Passage through Matter" is divided into sections on properties of α rays, elastic collisions between α particles and nuclei, and inelastic α-nucleus collisions. Part two is entitled "Canal Rays and their Interactions with Matter (Including Mass Spectrography)" and contains sections on: production and measurement methods, electrical and magnetic deflection, the mass spectrograph, and interactions of canal rays with matter. (T.R.H.)

Astrophysics and Cosmology

14228

UPPER LIMIT FOR THE ANISOTROPY OF INERTIAL MASS FROM NUCLEAR RESONANCE EXPERIMENTS. V. W. Hughes, H. G. Robinson, and V. Beltran-Lopez (Yale Univ., New Haven). Phys. Rev. Letters 4, 342-4 (1960) Apr. 1.

Experiments are described for determining an upper limit for the anisotropy of inertial mass by employing nuclear magnetic resonance in the ground state of nuclei. From this experiment, an upper limit of $\Delta m/m \leq 10^{-20}$ (m is the isotropic part and Δm is the anisotropic part of the total inertial mass of a body) was determined. Experiments on the anisotropy of inertial mass by observing Zeeman effects are compared. (C.J.G.)

14229

ISOTOPIC COMPOSITION OF PRIMORDIAL XENON. J. H. Reynolds (Univ. of California, Berkeley). Phys. Rev. Letters 4, 351-4(1960) Apr. 1.

A large excess of Xe^{129} and secondary anomalous abundances for many of the other isotopes of xenon were previously reported for the meteorite, Richardton. Similar secondary anomalies in xenon are reported for the meteorite Murray. For every isotope other than Xe^{129}, the ratio of the Murray percent abundance to the Richardton percent abundance was the same for both meteorites. The secondary anomalous xenon component was more abundant in Murray than in Richardton by a factor of 43. Mechanisms of this anomaly are discussed. An analysis by isotope dilution of all rare gases in the two stones is compared. (C.J.G.)

14230

ON THE INTERNAL STRUCTURE OF SUPER-DENSE STARS. D. A. Kirzhnits. Zhur. Eksptl'. i Teoret. Fiz. 38, 503-8(1960) Feb. (In Russian)

The properties of a condensed-state–plasma phase transition in ultra-compressed matter are discussed and it is concluded that the core of dense white dwarfs may be in a condensed state. From these conclusions it is stated that the rate of nuclear processes is much lower (compared to that in a plasma) and the possible concentration of hydrogen in the matter of white dwarfs may be much higher. (auth)

Cosmic Radiation

14231 AFOSR-TN-60-288

Maryland. Univ., College Park.

LIFETIMES OF GEOMAGNETICALLY TRAPPED PARTICLES DETERMINED BY COULOMB SCATTERING. Robert C. Wentworth. [1960]. 107p. Contract AF49(638)-530.

It can be shown that a low-energy particle once trapped in a pure dipole magnetic field will remain trapped forever. However, in the case of the real earth, various mechanisms exist which limit the lifetimes of these particles, such as collisions with atoms and ions in the earth's outer atmosphere, charge exchange (important for trapped protons of low energies), and scattering by hydromagnetic waves. In addition, particles with a large radius of gyration in the magnetic field have a limited lifetime because of the breakdown of the so-called adiabatic invariance of their magnetic moment. The effect of Coulomb scattering by ions of the earth's outer atmosphere on the life-times of the trapped particles is discussed in detail. Fast particles, scattered by single-particle Coulomb collisions, perform a random walk in phase space until they reach a low pitch angle (measured from the magnetic line of force). They then travel along the line of force until they reach the dense lower atmosphere where they lose their energy rapidly and are absorbed, thus being effectively removed from the trap. The model of a static dipole magnetic field and ionic exosphere is assumed. Details of the motion of the particles in the field are derived. The effect of scattering on removing the particles from the trapping regions is discussed. (auth)

14232

THE TRANSITION EFFECT OF THE NEUTRON-PRODUCING COMPONENTS.OF COSMIC RADIATION

IN LEAD. I. Hauser (Deutsche Akademie der Wissenschaften, Berlin). Ann. Phys. (7) 5, 327-34(1960). (In German)

With boron-loaded Agfa K3 nuclear emulsion the neutron production by cosmic radiation in lead up to 2.4 cm thick was measured. The results obtained with the different absorbing arrangements show a smooth pattern of the integral neutron production curve corresponding to an exponential decrease of the producing radiation. An indication of a maximum observed earlier between 1 to 2 cm lead could not be established. (tr-auth)

14233

THE TRANSITION EFFECT OF THE STAR-PRODUCING COMPONENTS OF COSMIC RADIATION IN LEAD. I. Hauser, P. Landrock, K. Lanius, L. Mitrani, and A. Peeva (Deutsche Akademie der Wissenschaften, Berlin and Bulgarische Akademie der Wissenschaften, Sofia). Ann. Physik (7) 5, 335-8(1960). (In German)

The transition effect of the star-producing component of cosmic radiation was investigated under lead at 3000 m altitude. A maximum of the star frequency was not observed under 1 to 2 cm Pb. This result is in agreement with the theoretical predictions. (tr-auth)

14234

RELATIONS BETWEEN THE PERTURBATIONS OF THE INTENSITY OF COSMIC RADIATIONS AND THE STRUCTURE OF SOLAR ACTIVITY. André Fréon, Jean-Pierre Legrand, and Michel Trellis. Compt. rend. 250, 2550-52(1960) Apr. 4. (In French)

An attempt was made to define the relationships between the "prebaisse" type of perturbations and the phase stability of recurrent variations of the radiation connected to the period of solar rotation. The results summarized are relative to the period from April 15, 1957, the beginning of solar rotation No. 1386, to August 8, 1959, the end of rotation No. 1416, a total of 31 consecutive solar rotations. As an index of solar activity the intensity of the corona ray 5303 A was used. The average daily values of the intensity of the cosmic radiation and the days of the beginning of prebaisses were graphed as a function of the longitude of the central solar meridian. The variations in per cent with respect to the mean intensity of the nuclear component of cosmic radiation are given. The corona curve has a sharp maximum near 320° longitude. The phase stability of the recurrent variations of the cosmic intensity was maintained to the end of the period. It was proposed that the prebaisses are caused by the effect of particle clouds and that they can be less intense than the radical jets responsible for storms, but emitted in a more continuous and isotropic fashion. (J.S.R.)

14235

THE NATURE OF CORPUSCULAR RADIATION IN THE UPPER ATMOSPHERE. I. S. Shklovskiĭ, V. I. Krasovskiĭ, Yu. I. Galperin. Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 12, 1799-1806(1959) Dec. (In Russian)

The particle concentration in solar corpuscle flux was found to be sufficient to restore outer belt corpuscles within a few hours. Calculations of the energetic proton spectrum and of the corpuscle generation rate inside the belt were based on the mechanism of decay in neutron stars with considerations for their diffusion through the atmosphere. Recordings of strongly charged nuclear explosion particle products temporarily distort the measurements of corpuscle radiation intensity in the earth crown, especially in the high-energy region. (R.V.J.)

14236

COSMIC RAY INTENSITY IN INTERPLANETARY SPACE. H. Elliot (Imperial Coll. of Science and Tech., London). Nature 186, 299-300(1960) Apr. 23.

A model of the interplanetary magnetic field is presented in which the cosmic-ray time variations are explained in terms of a rather regular interplanetary magnetic field generated by current systems flowing in the solar corona and having a high degree of axial symmetry. A solution is presented of the diffusion equation appropriate to this model. (C.H.)

14237

INVESTIGATIONS IN CONNECTION WITH THE UNUSUAL INTENSITY INCREASE OF THE "COSMIC RESIDUAL RADIATION" IN JULY AND AUGUST 1959. Luise Holzapfel (Max-Planck-Institut für Silikatforschung, Berlin). Naturwissenschaften 47, 130(1960). (In German)

Activation measurements, made with a Geiger tube in a steel casing, have yielded for a long time almost constant values for the cosmic unscreened residual radiation. These values were 13 to 18 pulses/min, with a maximum not over 20 pulses/min. At the end of June an unusual increase in the intensity was observed. A comparison with the measurements made in the previous year showed an increase for July, but not as high as the one observed in 1959. To establish whether air impurities affect the radiation values measured, aerosol condensates on various components were investigated. The values obtained are graphed. (J.S.R.)

14238

HEAVY NUCLEI IN THE PRIMARY COSMIC RAYS OVER MINNESOTA. Eiji Tamai (Univ. of Minnesota, Minneapolis). Phys. Rev. 117, 1345-51(1960) Mar. 1.

An analysis of the heavy primary cosmic rays ($Z \geq 2$) was made on a stack of emulsions exposed at a high altitude on September 18, 1956, over Minnesota. In order to examine the low rigidity portion of the heavy primary cosmic rays, only the stopped particles in this stack were studied. Two methods of identification of the charges of various particles were used, track width measurement and δ-ray density vs residual range. The energy spectra of α, L, and M groups in the primary cosmic radiation were obtained and show the existence of a maximum in each group, the regions of the maxima increasing with the charge of the element. Some possible interpretations of these spectra are discussed. (auth)

14239

ENERGY DEPENDENCE OF TRANSIENT CHANGES IN THE PRIMARY COSMIC-RAY SPECTRUM. K. G. McCracken (Univ. of Tasmania, Hobart). Phys. Rev. 117, 1570-9(1960) Mar. 15.

Quantitative comparisons are made between the cosmic-ray intensity variations observed by a Geiger counter telescope and ionization chamber at a high geomagnetic latitude, high latitude neutron monitors at sea level, and at two different mountain altitudes, Geiger counter telescopes situated 40 meters of water equivalent underground, and a neutron monitor and Geiger counter telescopes at a low geomagnetic latitude. Long-term and short-term variations are considered. As the intensity variations were large, and as the instruments were all of good statistical accuracy, considerable reliance can be placed in the determinations. It is shown that similar comparisons published by other investigators are in agreement with these determinations, provided adequate allowance is made for the altitudes at which the data were obtained. Writing the differential energy spectrum of the primary cosmic radiation as j(E), and measuring E in Bev, the inter-instrument comparisons are used to show that the average spectral changes approximate to the law $\delta j(E) = \text{const}\ (1 + E)^{-\beta} j(E)$;

where $\beta \approx 0.9$ for short-term variations, and $\beta \approx 1.2$ for long-term variations. It is shown that the amplitude of the long-term variation is markedly dependent upon altitude. Some evidence is presented that there might be a north-south asymmetry in the long-term variation, the amplitude being greater in southerly directions. (auth)

14240

ANGULAR DISTRIBUTION OF FAST PARTICLES IN NUCLEAR INTERACTIONS. V. M. Chudakov. Pribory i Tekh. Ekspt. No. 6, 37-8(1959) Nov.-Dec. (In Russian)

The angular distribution of shower particles from interactions in emulsion was measured by a method based on determining the coördinates of copunctual tracks within a sphere whose center coincided with the shower crest. (tr-auth)

14241

VARIATIONS OF INTENSITY AND ANISOTROPY OF COSMIC RAYS MEASURED AT THE GEOMAGNETIC EQUATOR. V. Sarabhai and Satyaprakash (Physical Research Lab., Ahmedabad, India). Proc. Indian Acad. Sci., Sec. A 51, 84-116(1960) Feb. (In English)

A study of cosmic-ray intensity variations was conducted during 1956—57 at the equatorial mountain station of Kodaikanal, using a standard neutron monitor. The data have been examined for the relationship between the day-to-day changes of intensity, the variance of bi-hourly deviations, the occurrence of large bi-hourly deviations at different hours of the day, and the associated parameters of the daily variation. The results are related to the electromagnetic state of interplanetary space as determined by streams of solar matter in the neighborhood of the earth, carrying with them frozen magnetic fields. Comparison is made with the model elaborated by Dorman. The principal conclusions are given. (auth)

14242

POLARIZATION OF COSMIC RAY μ^+-MESONS IN THE HIGH ENERGY REGION. N. M. Kocharyan, Z. A. Kirakosyan, E. G. Sharoyan, and A. P. Pikalov (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Ekspt'. i Teoret. Fiz. 38, 18-21(1960) Jan. (In Russian)

Measurements were made of the polarization of cosmic ray μ-mesons with energies close to 2 Bev. The obtained value of $P = 0.23 \pm 0.12$ indicates that in the higher atmosphere μ-mesons predominately originate in π-meson decay. As follows from the data, the number of μ-mesons produced due to $K_{\mu 2}$ decay cannot exceed 15% of the total number of μ-mesons. (auth)

14243

ELECTRON-PHOTON SHOWERS WITH ENERGIES FROM 10^{11} TO 10^{13} ev IN NUCLEAR EMULSIONS. A. A. Varfolomefev, R. I. Gerasimova, I. I. Gurevich, L. A. Makarina, A. S. Romantseva, and S. A. Chueva. Zhur. Ekspt'. i Teoret. Fiz. 38, 33-45(1960) Jan. (In Russian)

Examinations were made of 15 electron-photon showers with energies from 10^{11} to 10^{13} ev recorded in emulsion stacks. Energies of primary quanta causing showers were determined by measuring the energy spectrum of cascade electrons at a depth of 2.5 to 3 rad units, and by the screening effect on the first pairs. The energy spectrum was measured of pairs, produced at a depth of 1.5 rad units. The results obtained agree with the calculations made taking into account the influence of multiple scattering and medium polarization on high energy electron bremsstrahlung. (auth)

14244

ULTRA-HIGH ENERGY EXTENSIVE AIR SHOWERS. A. T. Abrosimov, G. A. Bazilevskaya, V. I. Soloveva, and G. B. Khristiansen (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Ekstpl'. i Teoret. Fiz. 38, 100-07(1960) Jan. (In Russian)

Extensive air showers with the number of particles from 5×10^6 to 10^8 were investigated. Data are presented on absolute shower intensity, value spectrum exponent, space distribution of the electron-photon component and μ-mesons of these showers. Data on the electron-photon component indicate that either in the lower atmosphere there is no balance between the electron-photon and nuclear components in ultra-high energy showers, or else electron space distribution is determined not only by Coulomb scattering but also by particle angular divergence in nuclear-cascade elementary events. (auth)

14245

THE NUMBER OF EXTENSIVE ATMOSPHERIC COSMIC RAY SHOWERS NEAR SEA LEVEL. S. I. Mishnev, and S. I. Nickol'skiĭ (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 257-8 (1960) Jan. (In Russian)

A scheme is suggested for recording extensive showers and determining the number of particles by correlating the flux density at various points near sea level. Recordings were made of quadruple discharge coincidences which were not followed by triple coincidences in either of three counters placed at ~ 6 m from the center of the installation. The area of all counters (σ) in all recording channels, including anticoincidence channels, varied simultaneously ($\sigma = 0.4\text{m}^2$; 0.2m^2; 990 cm^2; 330 cm^2; and 165 cm^2). Numerical calculations of recorded showers are approximated to integral spectra $f(>n) = A/N^{1.45}$ with the assumption that charged particle spatial distributions are not related to the number of particles in the shower. The results are in good agreement with data obtained by T. Abrasimov et al. (Izvest. Akad. Nauk SSSR, Ser. Fiz. 19, 66(1955)). The results obtained for counter area $\sigma = 0.4\text{m}^2$ are plotted. The calculations and experimental data (for H = 200 m above sea level) are correlated, considering the spectrum value $A = 9 \times 10^4\ \text{m}^{-2} \cdot \text{hour}^{-1}$. (R.V.J.)

14246

ON THE FUNCTION OF THE SPATIAL DISTRIBUTION OF CHARGED PARTICLE FLUX IN AN INDIVIDUAL ATMOSPHERIC SHOWER. S. N. Vernov, N. N. Goryunov, V. A. Dmitriev, G. V. Kulikov, Yu. A. Nechin, and G. B. Khristiansen (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Ekspt'. i Teoret. Fiz. 38, 297-8(1960) Jan. (In Russian)

Experimental data are developed for charged particle flux distribution within 25 m from the shower axis. Twenty-six dense showers (with $n \geq 10^5$) were investigated. Experimental functions plotted for each of the selected showers were correlated with theoretical functions derived by Nishmura and Kamata for various magnitudes of cascade parameters. The data indicated the existence of various shower ages at sea level. (R.V.J.)

14247

INVESTIGATION OF A HIGH ENERGY INTERACTION EVENT IN A PHOTOGRAPHIC EMULSION. Kh. P. Babayan, M. T. Sarinyan, and E. R. Tumanyan. Zhur. Ekspt'. i Teoret. Fiz. 38, 313-18(1960) Feb. (In Russian)

A nuclear interaction involving a star of the 5 + 21 p type produced by a primary particle of ~10^{12} ev energy was investigated. An angular distribution of the secondary shower particles characterized by two maxima was obtained. This event was interpreted as a peripheral collision of two nucleons. The ratio of the number of neutral π-mesons to the total number of charged shower particles was found to be of the order of 0.4. An interaction of the 0 + 6 p type was detected, which is probably due to a single πN-collision following a peripheral collision of nucleons, (auth)

14248
TRANSITION EFFECT OF STARS PRODUCED IN LEAD AND GRAPHITE ABSORBERS BY COSMIC RAYS. T. V. Varsimashvili. Zhur. Eksptl'. i Teoret. Fiz. 38, 319-23 (1960) Feb. (In Russian)

Results of an investigation of the transition effect of stars produced in lead and graphite absorbers at an altitude of 3100 m above sea level are presented. Photographic emulsions were used in the experiments. The effect was, respectively, 30 and 10% in lead and graphite. The properties of particles producing the effects are discussed. (auth)

14249
EXPERIMENTAL INVESTIGATION OF THE ENERGY SPECTRUM OF THE PENETRATING COMPONENT OF EXTENSIVE AIR SHOWERS. E. L. Andonikashvili and R. E. Kazarov. Zhur. Eksptl'. i Teoret. Fiz. 38, 703-7 (1960) Mar. (In Russian)

The energy spectrum of the μ-meson component of extensive air showers was studied in the range from 0.4 to 37 Bev. The investigations were performed for three groups of showers possessing a mean particle number of $1.4 \cdot 10^4$, $7 \cdot 10^4$, and $2.9 \cdot 10^5$. The energy spectrum at an average distance of ~28 m from the axis was plotted for the three types of showers. The energy spectrum of the shower as a whole was determined. For all three shower groups the power exponent was approximately equal to one. (auth)

Criticality Studies

14250 CF-60-4-24
Oak Ridge National Lab., Tenn.
COMPARISON OF k_∞ MEASUREMENTS IN A CRITICAL ASSEMBLY WITH k_∞ MEASUREMENTS IN THE PHYSICAL CONSTANTS TESTING REACTOR. J. T. Mihalczo. May 3, 1960. 34p. Contract W-7405-eng-26. OTS.

The infinite medium multiplication factor, k_∞, for a homogeneous mixture of 2% U^{235}-enriched UF_4 in paraffin, was determined from a series of critical experiments in which known changes in the buckling were made and the resulting stable periods measured. The value determined, using a two-group model for the nonleakage probability, was 1.197 ± 0.09. Within the quoted errors this value is in agreement with an earlier value of $k_\infty = 1.216 \pm 0.013$ for the same material experimentally determined in the Physical Constants Testing Reactor. (auth)

Elementary Particles and Radiations

14251 AFOSR-TN-60-72
Johns Hopkins Univ., Baltimore.
THE MASS OF THE Λ^0 HYPERON (thesis). Edward Byerly Brucker. Jan. 1960. 81p. Contract AF18(603)-143.

The mass of the Λ^0-hyperon was determined in nuclear emulsion from the range and the relative orientation of the decay particles of twenty-five Λ^0 decays. The previous emulsion determinations of Friedlander, $Q_\Lambda = 36.9 \pm 0.21$ Mev, and Barkas, $Q_\Lambda = 37.45 \pm 0.16$ Mev, were in disagreement, and the average of their values led to a negative binding energy for the ${}_\Lambda H^3$ hyperfragment. The new determination resulted in a Λ^0 mass of 1115.55 ± 0.15 Mev, which corresponded to a Q-value of 37.71 ± 0.14 Mev. This new Q-value averaged with that of Barkas yielded a binding energy for ${}_\Lambda H^3$ of +0.12 ± 0.26 Mev. (auth)

14252 AFOSR-TN-60-354
Maryland. Univ., College Park.
K^--DEUTERON SCATTERING AND THE K^--NUCLEON SCATTERING LENGTHS. Physics Department Technical Report No. 167. T. B. Day, G. A. Snow, and J. Sucher. Mar. 1960. 9p. Contracts AF49(638)-24 and AT(40-1)-2504. OTS.

Results of calculations are given, including multiple-scattering corrections, on the $K^- - d$ cross sections for the four Dalitz and Tuan pairs of $K^- - N$ scattering lengths. Cross sections for elastic plus breakup scattering and charge-exchange scattering, total cross sections, and the cross sections for absorption of K^- by deuterons are given. (W.D.M.)

14253 CNC-25
Italy. Comitato Nazionale per le Ricerche Nucleari. Divisione Studi e Ricerche, Rome.
SULLO SPETTRO NEUTRONICO INTEGRALE IN UN PROBLEMA DIPENDENTE DAL TEMPO. (On the Integral Neutron Spectrum in a Time Dependent Problem). V. Benzi. Feb. 1960. 10p.

The slowing-down equation governing the neutron time-dependent distribution in the case of heavy mass scatterer is solved in an elementary approximate manner. Results are in good agreement with those obtained by use of more rigorous treatments. (auth)

14254 IFA-EM-37
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
MULTIPLE MESON PRODUCTION BY 9 BEV PROTONS ON EMULSION NUCLEI. (Generare Multiplă de Mezoni la Ciocnirea Protonilor de 9 Bev cu Nucleele Emulsiei). E. Friedländer. 1959. 30p.

Multiple meson production by 9-Bev protons on emulsion nuclei was investigated. The method of discrimination between heavy and light nuclei, which provides a simultaneous check on the validity of the tunnel model, is analyzed. The angular distribution of the shower particles was determined. The problem of energy transfer in meson showers was investigated. (C.J.G.)

14255 NDA-2120-3
Nuclear Development Corp. of America, White Plains, N. Y.
RENUPAK, AN IBM-704 PROGRAM FOR NEUTRON MOMENT CALCULATIONS. J. Certaine, E. DeDufour, and G. Rabinowitz. Dec. 1, 1959. 22p. Project No. VI. Contract AT(30-1)-2303. OTS.

Calculations of neutron penetration in infinite homogeneous media due to isotropic point and plane sources have been performed using NUPAK, a Univac program based on the moment method. An IBM-704 version (RENUPAK) which treats the fission process in addition to the anisotropic elastic scattering and isotropic inelastic scattering processes handled by NUPAK is described. Input requirements, description of output format, and operating instructions are included. (auth)

14256 NP-8467
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
CENTRAL AND PERIPHERAL COLLISIONS BETWEEN FAST NUCLEONS. [PART] II. V. S. Barashenkov and V. M. Maltsev. 1959. 21p. (P-433). Part I issued as NP-7793.

Theoretical momentum spectra of particles produced in nucleon collisions are compared with experimental data at 9 Bev. The mean energy losses in inelastic collisions were calculated. Central and peripheral collisions were considered. (auth)

14257 NP-8597
Liverpool. Univ.
THE CAPTURE AND DECAY INTERACTIONS OF NEGATIVE MUONS STOPPED IN MATTER (thesis). Norman H. Lipman. Sept. 1959. 80p.

The muon capture process ($\mu^- + p \rightarrow n + \nu$) is discussed, and an experiment is described in which muon capture rates were measured to accuracies of a few per cent for various target nuclei. The main interest of the experiment was to make a comparison between measured capture rates and the theoretically predicted capture rates of Tolhoek and Luyten. The theory is sensitive to the type of coupling that prevails in the muon capture process, and Tolhoek and Luyten have derived two values for the capture rate in each element considered, one for a Fermi type of coupling (pseudoscalar, scalar, and vector) and the other for Gamow-Teller coupling (axial vector and tensor). A comparison between experiment and theory over a range of selected elements should in principle detect whether the coupling is pure Fermi, pure Gamow-Teller, or a mixture of the two. The results, in fact, favor an excess of the Gamow-Teller over the Fermi type of coupling. The perturbation of the muon decay process ($\mu^- \rightarrow e^- + \nu + \bar{\nu}$) brought about by atomic binding is considered. A muon in orbit within a muonic atom may be expected to decay at a modified rate; this was investigated experimentally for negative muons stopped in aluminum and in copper. It is shown that there is no deviation from the free muon decay rate within the experimental standard deviation of 5%. (auth)

14258 NYO-2170
Rochester, N. Y. Univ.
π-P SCATTERING AT LOW ENERGIES. S. W. Barnes, B. Rose, G. Giacomelli, J. Ring, and K. Miyake. Mar. 20, 1958. 25p. Contract AT(30-1)-875. OTS.

Pion-proton differential scattering cross sections were measured at 41.5 Mev at six angles for π^+, and at five for π^-. A phase-shift analysis was made of these data. Analyses were also made on π differential cross sections at 24.8, 31.5, and 60 Mev. (W.D.M.)

14259 NYO-9029
Rochester, N. Y. Univ.
BREMSSTRAHLUNG IN p-p COLLISIONS AT AN ENERGY OF 150 MEV. C. Dullemond and J. J. de Swart. 1959. 12p. OTS.

The differential cross section for bremsstrahlung in p-p collisions at an energy of 150 Mev is calculated at the upper end of the photon spectrum. The only transition which is considered is the E2 transition between $^1D_2$ and the $^1S_0$ state. The Siegert theorem is used and the influence of the Coulomb force between the two protons is neglected. (auth)

14260 NYO-9030
Rochester, N. Y. Univ.
SIMPLE METHOD FOR OBTAINING SCATTERING SOLUTIONS OF COUPLED SCHRÖDINGER EQUATIONS. J. J. de Swart and P. J. Eberlein. Mar. 24, 1960. 13p. Contract AT(30-1)-875. OTS.

The Schroedinger equation for nucleon-nucleon scattering (including tensor coupling) and for hyperon-nucleon scattering is written in the matrix form $u'' = Au$. A simple method is developed to solve n coupled differential equations of this type. The scattering matrix is explicitly constructed. This method is specially suited for use with a high speed electronic computer. (auth)

14261 UCRL-8845
California. Univ., Berkeley. Lawrence Radiation Lab.
[PART] I. · K^+ CHARGE EXCHANGE SEARCH FOR K^+ CHARGE EXCHANGE. Robert W. Birge, Hans J. Courant, Robert E. Lanou, Jr., and Marian N. Whitehead. July 29, 1959. 19p. Contract W-7405-eng-48. OTS.

A beam of 480 Mev/c K^+ mesons incident on targets of tungsten and copper inside a triggered, multiplate cloud chamber was used to look for the reaction $K^+ + n \rightarrow K^0 + p$. No events were found that could be interpreted as either the decay or interaction of neutral K mesons. Possible explanations of the result are presented. (auth)

14262 UCRL-8846
California. Univ., Berkeley. Lawrence Radiation Lab.
[PART] II. K^+ CHARGE EXCHANGE PRODUCTION OF K^0 MESONS BY CHARGE EXCHANGE OF K^+ IN PROPANE. Marian Whitehead, Robert E. Lanou, Jr., Robert W. Birge, Wilson M. Powell, and William B. Fowler. July 29, 1959. 11p. Contract W-7405-eng-48. OTS.

The reactions $K^+ + n \rightarrow K^0 + p$ and $K^0 \rightarrow \pi^+ + \pi^-$ were observed in reactions of a 200-Mev K^+ beam in propane. The charge exchange cross section for the two events was calculated to be 0.6 mb per carbon neutron (uncorrected for scanning efficiency). (For Part I see UCRL-8845.) (C.J.G.)

14263 USNRDL-TR-409
Naval Radiological Defense Lab., San Francisco.
A METHOD OF CALCULATING THE DENSITY OF THERMAL NEUTRONS IN A SLAB. F. Forelli. Mar. 17, 1960. 26p. OTS.

An application of Grossjean's method of calculating multiple scattering of particles was made for the case of a plane isotropic source of thermal neutrons in a slab of finite thickness. The method involved the expansion of the neutron distribution in Legendre polynomials. Hand computations were carried out to the fourth order with the results indicating that a much higher order is needed. The method is suitable for use with an electronic computing machine. (auth)

14264 WADD-TR-59-4
Wright Air Development Div. Materials Lab., Wright-Patterson AFB, Ohio.
MEASUREMENT OF SCATTERED GAMMA RAYS BY In FOIL ACTIVATION. [Period covered] June 1958 to November 1959. Michael P. Charles. Dec. 18, 1959. 21p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: RADIATION EFFECTS AND MEASUREMENTS. OTS.

Measurements of scattered radiation components of pure gamma-ray sources used in radiation effects studies are presented. The method developed involves the excitation of metastable levels in such materials as In, Cd, Ag, Lu, Hg, Pt, Hf, Sr, and Rh, by gamma-ray inelastic scattering processes. The direct excitation of the metastable states is forbidden, but these levels can be excited indirectly if the Co^{60} gamma rays have been degraded in energy-so that the remaining energy corresponds to that of a level higher than the metastable levels but which decays immediately to the metastable level. Only In was used, therefore the source was mapped for only one particular secondary gamma-ray energy-0.860 Mev. For a cylindrical source the intensity versus distance from the source wall was found to be a linear function in water. (auth)

14265
GENERAL LAGRANGIAN AND CANONICAL FORMALISM DESCRIBING THE RELATIVISTIC MOTION OF A FREE ROTATING PARTICLE. F. Halbwachs (Institut Henri Poincaré, Paris). Acta Phys. Polon. 19, 93-114(1960). (In English)

The problem of a relativistic rotating particle is treated in Lagrangian form by use of the results of a hydrodynamic theory developed by the author. The treatment is limited to simple cases such as zero external field, and the Lagrangian is chosen to be linear. The resulting formalism can be used to frame a fluid with intrinsic rotation and an underlying particle structure admitting of chaotic motion, for which both non-covariant and covariant hamiltonians are given. The formalism is also subjected to quantization and new wave equations connected with the spin concept are given. (auth)

14266

CLASSICAL RADIATION FROM A UNIFORMLY ACCELERATED CHARGE. Thomas Fulton and Fritz Rohrlich (Johns Hopkins Univ., Baltimore). Ann. Phys. (N. Y.) 9, 499-517(1960) Apr.

The old and much-debated question, whether a charge in uniform acceleration radiates, is discussed and its implications are noted. Many contradictory statements in the literature are analyzed and those answers which can be given on the basis of the standard classical Maxwell–Lorentz equations are presented. Although the questions that remain open are difficult and fundamental, some simple results can be proved: Contrary to claims in some standard sources (Pauli, von Laue), a charge in uniform acceleration does radiate. The radiation rate is finite, invariant, and constant in time in the instantaneous rest system. There is no contradiction of this fact with either the principle of conservation of energy or the principle of equivalence. Finally, the group of conformal transformations is found to be not physically meaningful. (auth)

14267

GALILEAN INVARIANCE AND THE SCHRÖDINGER EQUATION. Morton Hamermesh (Argonne National Lab., Lemont, Ill.). Ann. Phys. (N. Y.) 9, 518-21(1960) Apr.

The Schrödinger equation is derived from the assumptions of Galilean invariance and the existence of a momentum operator acting within an irreducible representation of the Galilei group. (auth)

14268

THE MANY π-MESON PROBLEM. A. Pais (Institute for Advanced Study, Princeton, N. J.). Ann. Phys. (N. Y.) 9, 548-602(1960) Apr.

It is shown that the properties of a system of N π-mesons are to a considerable extent determined by three quantum numbers ($N_1N_2N_3$), the "correlation numbers" whose sum equals N. In a state with definite correlation (specific values of $N_1N_2N_3$), these numbers relate to the number of triples: 3π-subsystems with $I = 0$; the number of pairs: 2π systems with $I = 1$ and the remaining singles out of which such a state can be composed by a well-defined prescription. For states with definite correlation, the correlation numbers dictate which I-spin values such states can possibly have. For systems with $I < 2$ ("$N\pi$-clouds") the correlation numbers determine the I-spin uniquely. The branching ratios for an $N\pi$-cloud into the various charge distributions compatible with given N and total charge are not uniquely determined if only the I-spin of a specific state is given. It is shown that unique results are obtained if one is given the correlation numbers. General methods are developed for determining these ratios as functions of $N_1N_2N_3$. Tables are given for these ratios for $N = 2$ to 8. All results are compiled and rules are given for practical use and mathematical proofs are given. It is shown that the present results can be obtained without recourse to the explicit use of vector addition coefficients. The basic tools are Young's (nonorthogonal) representations of the symmetric group and Thrall's theorem on its orthonormal idempotents. Applications to annihilation processes are discussed with special reference to $\bar{p}$-p and $\bar{p}$-d annihilation. Zero- and two-prong star theorems are given. A statistical model for $\bar{p}$-p and $\bar{p}$n-annihilation predicts that, with increasing N, the ratio of the average number of charged π's to the average number of neutral π's produced in $N\pi$-annihilation becomes nearly equal to 2. The predominance of specific correlations could lead to substantially different values for this ratio. The connection between charge correlations and spatial correlations as well as some dynamical aspects of the problem are briefly discussed. (auth)

14269

ON THE PROBLEM OF TRANSFORMATION PROPERTIES OF THE SPIN PSEUDO-VECTOR. A. A. Sokolov, I. M. Ternov, and Yu. (Ju.) M. Loskutov (Moscow State Univ.). Ann. Physik (7) 5, 241-8(1960). (In English)

The polarization 4-vector of Dirac's particles is introduced by the covariant method, and its transformation properties are investigated. The results obtained are used to discuss the phenomena related to parity nonconservation. (auth)

14270

ON NONLOCAL EFFECTS IN WEAK INTERACTIONS. M. Hessler (Univ. of Stockholm). Arkiv Fysik 16, 533-40(1960). (In English)

Weak interactions are assumed to be slightly nonlocal, due to the occurrence of a heavy intermediate particle. When the term for this particle is eliminated from the Lagrangian, an expression arises in which the lepton and nucleon currents interacting at different points are coupled by a Yukawa potential. The nonlocal effects in the inverse β process, $p + e^- \rightarrow n + \nu$, and in μ decay are calculated using V–A coupling. It is found that the value of the Michel parameter tends to increase above 0.75. The coupling constant, g^2, used in the nonlocal interaction Hamiltonian, has the dimension of charge squared in contrast to the constant of the local theory, which has the dimension of charge squared times length squared and is the one experimentally determined. By studying the relation between these two constants it is found that the experimental g value which limits the characteristic length for the nonlocal effect to $\approx 10^{-13}$ cm gives a corresponding limitation to g^2 of $g^2 \geq 10^{-24}$ cgs units. (auth)

14271

IS THE APPLICATION OF A LEAD EQUIVALENT TO THE ESTIMATION OF THE PROTECTIVE EFFECT OF A MATERIAL AGAINST γ RADIATION STILL USEFUL? H. G. Ebert (Universität, Göttingen, Ger.). Atompraxis 6, 88-91 (1960). (In German)

It is pointed out that listing the lead equivalent in order to characterize the protective effect of a material cannot be considered generally valid. It is shown that the lead equivalent can still be useful in measuring a radiation-protection material under narrow-beam radiation, although it is easier and more accurate to use the attenuation coefficient. However, the listing of a lead equivalent is inadequate for measurements with large field cross sections. In general, the lead equivalent is determined practically for only a relatively thin layer and cannot be calculated for thicker layers. In addition, determining the actual attenuation of radiation by a material is very difficult with the use of the lead equivalent. The measurements are also unnecessarily complicated and the margin of error is increased. The listing of μ and the course of the build-up factor B is completely sufficient. (auth)

14272

FOURTH ORDER MESON EQUATION AND NEUTRON-PROTON SCATTERING. S. P. Misra (Ravenshaw Coll., Cuttack, India). Indian J. Phys. 34, 92-7(1960) Feb. (In English)

The neutron-proton differential scattering cross-section was derived with a fourth order meson equation proposed by Bhabha and Thirring, which was useful in explaining the anomalous magnetic moments of nucleons. For moderate energies, the results disagree as violently with experiments as for conventional meson theory satisfying the Klein-Gordon equation. (auth)

14273

SMALL ANGLE SCATTERING OF X-RAYS BY PLASTICALLY DEFORMED SINGLE CRYSTALS. W. H. Robinson and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). J. Appl. Phys. 30, 617-21(1959) May.

The small-angle scattering of x rays from single crystals of magnesium plastically deformed by simple shear was measured in the angular range of 4′ to 5°. The crystals were subjected to both unidirectional and cyclic shear stresses applied along the $[1 1 \bar{2} 0]$ direction. Thin slices of the deformed single crystals were prepared using strain-free cutting and polishing techniques. The thin slices had orientations such that the slip direction was either parallel or perpendicular to the incident x-ray beam in order to observe any anisotropy in the scattering that might be due to dislocations. It was found that those samples which contained deformation twins within the irradiated volume produced rather large scattered intensity. This scattered intensity is interpreted as being due to double Bragg scattering. The scattered intensity from other specimens was attributed to surface scattering. No evidence for small angle scattering by dislocations was found. (auth)

14274

A PROPRIETY LIMIT FOR THE MEAN WAVE IN FUNCTION THEORY OF PARTICLE SYSTEMS. Jean-Louis Destouches (Institut Henri-Poincaré, Paris). J. phys. radium 21, 145-8(1960) Mar. (In French)

It is shown that under four conditions the mean wave for a great number of particles in the nonlinear functional theory of particles obeys a linear equation with a probability very near unity. This equation is the same as the wave equation in the usual wave mechanics for the corresponding problem. Thus, the linear part of the equation for the u-wave in the functional theory of particles is determined. (auth)

14275

RENORMALIZATION OF A STRONG NUCLEON, HYPERON, MESON K INTERACTION WITHOUT PARITY CONSERVATION. Roger Nataf (Laboratoire de Physique Nucléaire, Orsay, France). J. phys. radium 21, 174-84 (1960) Mar. (In French)

The consequences of such an interaction as suggested by Soloviev are investigated (PC invariance being assumed). Second-order corrections for dressed particles (propagators, vertex operators, etc.) are calculated, and it is found that the Σ dressed field has a mixed parity with respect to the nucleon dressed field. This result is eliminated by renormalization, performed for all orders, carried out nearly in the same way as d'Espagnat and Prentki, some relations being, however, different. (auth)

14276

ON THE PROBLEM OF NEUTRON DIFFUSION. N. G. Van Kampen. Koninkl. Ned. Akad. Wetenschap., Proc. Ser. B. 63, 92-107(1960).

Equations are derived for the transfer of radiation through an atmosphere and the diffusion of particles through a medium. A general equation is solved for flat layer, homogeneous medium, and elastic and isotropic scattering processes. Parameters in the equation are adjusted to give any set of prescribed distributions for the incident particles. (B.O.G.)

14277

SOME RESULTS CONCERNING HEAVY UNSTABLE NUCLEAR FRAGMENTS EJECTED FROM INTERACTION OF 4.5 GeV π^- IN EMULSION. M. de Pretis and G. Poiani (Università, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuovo cimento (10) 15, Suppl. No. 3, 265-81(1960). (In English)

Results are given from an investigation of a stack of 600 μm Ilford G-5 emulsions, exposed to 4.5-Bev π^- mesons. The nature, emission spectra, and angular distributions of unstable nuclear fragments and hyperfragments produced in the emulsions were studied. The ejected fragments selected for characterization studies were Li^8, Li^9, Be^8, B^8, B^{12}, and C^{12}. The modes of decay and excited levels are outlined for these fragments. Data on 29 hyperfragments identified with certainty are reported. Their angular and energy distribution does not support the view that their mechanism of production is substantially different from that of unstable fragments of nonhyperonic origin. (B.O.G.)

14278

ELEMENTARY PARTICLE REACTIONS. [PART] II. H. C. Meyer, III and W. G. Holladay (Vanderbilt Univ., Nashville). Nuovo cimento (10) 15, Suppl. No. 3, 387-401 (1960). (In English)

A method is presented for determining possible reactions for elementary particles. This method was used to find the reactions for Λ, Σ, Ξ, $\bar{\Xi}$, $\bar{\Sigma}$, and $\bar{\Lambda}$ incident on a nucleon at rest and in motion in a nucleus. The ORACLE at Oak Ridge National Laboratory was used to calculate the threshold energies for the reactions. An equation was derived for maximum kinetic energies for the products produced in the processes discussed. Plots of the energies are given as a function of the kinetic energy of the projectile. (B.O.G.)

14279

STATISTICAL WEIGHTS OF MANY-PARTICLE SYSTEMS IN SPIN OR ISOSPIN SPACE. F. Cerulus (European Organization for Nuclear Research, Geneva). Nuovo cimento (10) 15, Suppl. No. 3, 402-25(1960). (In English)

A theory is developed for high-energy nucleon-nucleon collisions, where the end-particles have to combine to yield states of given total isospin and charge. Charge distribution coefficients P^J were determined for systems composed of spin $\frac{1}{2}$, 1, and $\frac{3}{2}$ and all possible combinations of m's. These determined coefficients are given in tabular form for the prescribed conditions for use in statistical theories of meson production. Two checks are described for the accuracy of the tables. Both stem from the fact that the recoupling transformation is orthogonal. (B.O.G.)

14280

RADIATION DAMPING OF AN ELECTRON IN A UNIFORM MAGNETIC FIELD. Gordon Gibson and Eugene J. Lauer (Univ. of California, Livermore). Phys. Rev. 117, 1188-90 (1960) Mar. 1.

Analytic solutions are given for the pair of differential equations obtained from classical theory which express the time rate of change of the angle between the momentum vector and the magnetic field vector and the time rate of change of the energy of the electron. (auth)

14281

ELASTIC SCATTERING OF LOW-ENERGY ELECTRONS BY THE THOMAS-FERMI ATOM. Lawrence Baylor Robinson (Space Technology Labs., Inc., Los Angeles). Phys. Rev. 117, 1281-3(1960) Mar. 1.

A detailed study was made of the elastic scattering properties of the Thomas-Fermi atom for low-energy electrons. The scattering lengths were determined for all atoms in the periodic table within the framework of the Thomas-Fermi approximation. The scattering length is a periodic function of the atomic number of the scattering atom. Both positive and negative scattering lengths are found. The effect of the sign and magnitude of the scattering length on the shape of the cross section vs. energy curve is studied. Atoms with negative scattering lengths are observed to have very low cross sections for some energy of the incoming electrons, but this is not the case for atoms having positive scattering lengths. (auth)

14282

ANALYSIS OF ALPHA-PARTICLE ELASTIC SCATTERING EXPERIMENTS. J. A. McIntyre, K. H. Wang, and L. C. Becker (Yale Univ., New Haven). Phys. Rev. 117, 1337-8 (1960) Mar. 1.

By a simple modification of the sharp cutoff (Blair) approximation, a phase-shift analysis was found to reproduce the experimental alpha-particle elastic scattering data from silver. Only two adjustable parameters were required to fit the experimental data for 22-Mev scattering; four parameters were used for the 40-Mev data. (auth)

14283

PHOTOPRODUCTION OF NEUTRAL PIONS AT FORWARD ANGLES. Karl Berkelman and James A. Waggoner (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 117, 1364-75(1960) Mar. 1.

The reaction $\gamma + p \rightarrow \pi^0 + p$ over the photon energy range 250 Mev to 1 Bev for center-of-mass pion angles between 20 and 70° was studied using bremsstrahlung. The recoil protons, of energies between 10 and 60 Mev, were identified and their energies determined. Correlated pulse-height information was used to sort out the protons from mesons and electrons. The results show a somewhat smaller forward differential cross section above 400 Mev. The angular distributions indicate a $d_{3/2}$ assignment for the 760-Mev resonance level. Other implications of the data are also discussed. (auth)

14284

CHARGE-DEPENDENT CORRECTIONS TO PION-NUCLEON SCATTERING. Daniel M. Greenberger (Department of Defense, College Park, Md.). Phys. Rev. 117, 1378-93(1960) Mar. 1.

If account is taken of the mass difference between neutral and charged pions and of the possibility that the three coupling constants (π^0-n, π^0-p, $\pi^\pm$-nucleon) may differ, then the pion-nucleon system no longer conserves isotopic spin. This effect was investigated using Chew-Low theory with a p-state interaction. For each J value there are ten scattering amplitudes, replacing the two of the charge-independent case. Only eight of these amplitudes are independent due to time reversal invariance, and the mass difference effect can be related to a change in the energy scale. The amplitudes are determined as solutions to a set of linear integral equations which may be solved approximately in the one-meson approximation. Corrections to the differential cross sections are then calculated. These corrections go through a maximum at about 125 Mev and can affect the magnitude of the π^- cross sections by as much as 35% in this region, as well as the slope of the π^- cross section in the region 125 to 175 Mev, the effect on the π^+ cross section being small. Attempts are made to correlate the calculation with available data. (auth)

14285

INTERFERENCE EFFECTS IN HIGH-ENERGY BREMSSTRAHLUNG FROM CRYSTALS. L. I. Schiff (Stanford Univ., Calif.). Phys. Rev. 117, 1394-1401(1960) Mar. 1.

An attempt is made to interpret the negative results of Panofsky and Saxena and the positive results of Frisch and Olson in terms of the Überall theory of the interference effects in high-energy bremsstrahlung from crystals. Several of the theoretical approximations are examined in detail: the validity of the Born approximation, the calculation of temperature effects, the validity of the closure approximation for the crystal lattice, and the use of the Debye form for the lattice vibration spectrum. It is concluded that all of these are justified, except that a partial failure of the Born approximation may be responsible for the absence of the central minimum in the Frisch-Olson experiment. No explanation is found for the Panofsky-Saxena results. The interference is enhanced by large primary electron energy and small ratio of photon to electron energy. In the case of a diamond-type crystal the [1 1 0] direction for the electron beam is to be preferred to either the [1 0 0] or the [1 1 1] direction. (auth)

14286

DETERMINATION OF (Σ,K) RELATIVE PARITY. W. M. Frank, I. Goldberg, and R. M. Rockmore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 117, 1402-3(1960) Mar. 1.

Different relative parity assignments are shown to lead to distinguishable angular distributions in the $K^+ + K^+ + \overline{K}^0$ annihilation mode of unpolarized ($\overline{\Sigma}^-$,p) systems. An impact parameter argument limits consideration to the two cases λ, $l = 0, 1$ and λ, $l = 0, 1, 2$, where λ denotes the relative angular momentum of the $2K^+$ system and l, that of the $\overline{K}^0$ with respect to the center of mass of the $2K^+$ system. (auth)

14287

ELECTROMAGNETIC PROPERTIES OF π AND K MESONS. Katsumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 1403-6(1960) Mar. 1.

A formalism is proposed which can give a smaller mass for the charged than for the neutral K meson, but a larger mass for the charged than for the neutral π meson. The theoretical prediction agrees with the experimental mass difference $M(K^0) - M(K^+) \approx 9.4$ electron masses if the rms radius of the charge distribution of the K meson is equal to 0.48×10^{-13} cm. (auth)

14288

DECAY RATES OF BOUND NEGATIVE MUONS. D. D. Yovanovitch (Univ. of Chicago). Phys. Rev. 117, 1580-9 (1960) Mar. 15.

The decay rate of negative muons bound to nuclei of atomic number Z, $\Lambda_d(Z)$, was investigated experimentally by two independent methods: (a) the "sandwich" method, and (b) the "calibrated efficiency" method. Both methods are based on the fact that the negatron yield per muon, $y^-(Z)$, is proportional to $\Lambda_d(Z)/\Lambda_t(Z)$, where $\Lambda_t(Z)$ is the total disappearance rate of negative muons for element Z, and are designed to avoid absolute measurements of $y^-(Z)$. In method (a), μ^- are stopped in a multilayer "sandwich" target made by alternately stacking sheets of two elements Z, Z′, and the resultant e^- time distribution is decomposed into components due to Z and Z′. The ratio of muon stops in Z and Z′ is established empirically; knowing $\Lambda_d(Z')$, $\Lambda_d(Z)$ can be computed. This method was applied to Al, Fe, Zn, Cd, Mo, W, and Pb. In method (b), μ^- and μ^+ of identical range distributions are stopped in a given target, and the e^+ yield, y^+, is used as a calibration of the e^- counting efficiency. This method was applied to C, Ca, Ti, V, Mn, Fe, Co, Ni, Zn, I, and Pb. The sources of error of either method are discussed in detail. The results indicate: (1) In the range $20 < Z < 30$, $\Lambda_d(Z) > \Lambda_d(0)$, i.e., the bound decay rate exceeds the vacuum (i.e., μ^+) decay rate; $\Lambda_d(Z)$ presents a sharp peak near $Z = 26$. (2) For $Z > 30$, one finds $\Lambda_d(Z) < \Lambda_d(0)$, i.e., the decay is inhibited by binding. The effect is very marked for the heaviest elements, e.g., $\Lambda_d(82)/\Lambda_d(0) = 0.34 \pm 0.04$. These results are compared with the predictions of simplified theoretical models. The peak near $Z = 26$ is tentatively attributed to the Coulomb enhancement of the outgoing electron wave function at the point of decay. (auth)

14289

EQUIVALENT HAMILTONIANS IN SCATTERING THEORY. H. Ekstein (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 1590-5(1960) Mar. 15.

The extent to which the scattering matrix determines the hamiltonian is discussed. The hamiltonians considered are nonrelativistic, but in extension of previous studies, "nonlocal" potentials and many-body potentials are allowed. A large class of unitary transformations is found which produce hamiltonians leading to the same S matrix. It is shown that this equivalence is only a special consequence of the general axiomatic formulation of scattering in field theory. (auth)

14290

PARTIAL-WAVE DISPERSION RELATIONS FOR THE PROCESS $\pi + \pi \rightarrow N + \bar{N}$. William R. Frazer and Jose R. Fulco (Univ. of California, Berkeley). Phys. Rev. 117, 1603-8(1960) Mar. 15.

The problems of pion-nucleon and nucleon-nucleon scattering and nucleon electromagnetic structure involve the matrix element for two pions producing a nucleon-antinucleon pair. By use of the Mandelstam representation, dispersion relations for the partial-wave scattering amplitudes of this process may be written. In the low-energy range these dispersion relations can be transformed into integral equations whose kernels are simply related to pion-nucleon and pion-pion scattering amplitudes. (auth)

14291

EFFECT OF A PION-PION SCATTERING RESONANCE ON NUCLEON STRUCTURE. [PART] II. William R. Frazer and Jose R. Fulco (Univ. of California, Berkeley). Phys. Rev. 117, 1609-14(1960) Mar. 15.

It is shown that a resonance of suitable position and width in the $J = 1$, $I = 1$ state of the pion-pion system can bring the dispersion-theoretic calculation of the isotopic-vector part of the nucleon electromagnetic structure into agreement with experiment. The calculation of the isotopic-vector part of the nucleon form factors involves in first approximation the pion form factor and the matrix element for the production by two pions of a nucleon-antinucleon pair. For the pion form factor a semiphenomenological solution based on the work of Chew and Mandelstam and involving two parameters related to the position and width of the resonance was used. (auth)

14292

ELECTRON-NEUTRINO AND ELECTRON-ANTINEUTRINO SCATTERING. R. W. King and D. C. Peaslee (Purdue Univ., Lafayette, Ind.) and J. F. Perkins (Lockheed Aircraft Corp., Marietta, Ga.). Phys. Rev. 117, 1614-15(1960) Mar. 15.

Cross sections for electron-neutrino and electron-antineutrino scattering are given as a function of recoil electron energy, averaged over a reactor spectrum of antineutrinos. (auth)

14293

APPARENT WEIGHT OF PHOTONS. R. V. Pound and G. A. Rebka, Jr. (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters 4, 337-41(1960) Apr. 1.

The effect of gravitational potential on the apparent frequency of electro-magnetic radiation was measured by using the sharply defined energy of recoil-free 14.4-kev γ rays emitted by Co^{57} and absorbed in Fe^{57}. The mean gravitational shift in frequency was measured to be $(-17.6 \pm 0.6) \times 10^{15}$. (C.J.G.)

14294

TEMPERATURE-DEPENDENT SHIFT OF γ RAYS EMITTED BY A SOLID. B. D. Josephson (Trinity Coll., Cambridge, Eng.). Phys. Rev. Letters 4, 341-2(1960) Apr. 1.

It is shown that the low-energy γ rays emitted from nuclei in a solid which are unaffected by the Doppler effect are subject to a temperature-dependent shift to lower energy. It is demonstrated that this shift can be attributed to the relativistic time dilatation caused by the motion of nuclei. (C.J.G.)

14295

SIGNIFICANCE OF ELECTROMAGNETIC POTENTIALS IN THE QUANTUM THEORY IN THE INTERPRETATION OF ELECTRON INTERFEROMETER FRINGE OBSERVATIONS. Frederick G. Werner (Univ. of Cincinnati) and Dieter R. Brill (Princeton Univ., N. J.). Phys. Rev. Letters 4, 344-7(1960) Apr. 1.

The effect of electromagnetic potentials on the interference fringes in electron interferometers in which electron beams are split into separate component beams which travel along spatially separated paths before being recombined are examined. By using a quantum theory interpretation of these fringe observations, it is shown that these potentials contribute significantly to the stability of the fringe pattern. (C.J.G.)

14296

COLLISIONAL DE-EXCITATION OF (π^-,p) ATOMS. J. E. Russell and G. L. Shaw (Indiana Univ., Bloomington). Phys. Rev. Letters 4, 369-71(1960) Apr. 1.

Fields et al. determined the time t_a required by a π^- to be slowed from an initial velocity of 0.05c and absorbed in a hydrogen bubble chamber to be $(4 \pm 2) \times 10^{-12}$ sec. It is shown that this experimental value of t_a indicates that π^- mesons are absorbed predominantly from atomic S states with $n \geq 3$. A calculation of collisional de-excitation rates indicated that the minimum time required for π^- to reach a state with $n = 1$ or 2 exceeds t_a. It is shown that absorption from the 3S and 4S states is consistent with calculated de-excitation rates and may be accounted for by the Stark effect of reshuffling values in connection with the absorption of K^- mesons in hydrogen. (C.J.G.)

14297

ANALYSIS OF THE SCATTERING OF K^+ MESONS IN EMULSION. L. S. Rodberg (Los Alamos Scientific Lab., N. Mex.) and Univ. of Maryland, College Park) and R. M. Thaler (Los Alamos Scientific Lab., N. Mex. and Case Inst. of Tech., Cleveland). Phys. Rev. Letters 4, 372-5 (1960) Apr. 1.

An analysis of K^+-nucleon interactions in the $T = 0$ state in nuclear emulsions was made. P- and S-wave phase-shift parameters were determined for K^+ meson energies of 180, 255, and 340 Mev. (C.J.G.)

14298

POSSIBLE RESONANCES IN WEAK INTERACTIONS AND TEST OF THE INTERMEDIATE BOSON HYPOTHESIS OF TANIKAWA AND WATANABE. Toichiro Kinoshita (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters 4, 378-80(1960) Apr. 1.

Possible deviations of weak interactions at high energies from their low-energy behavior and whether the weak interaction is basically of the Fermi or Yukawa type are discussed. The identity of neutrinos emitted in $\pi^-\mu$ decay at high energies is discussed. It was found that if either the $\omega + n \rightarrow (B) \rightarrow \mu^- + p$ process or the $e^- + p \rightarrow (B \rightarrow e^- + p$ process was not detected in weak interactions, it would disprove the intermediate-boson theory of Tanikawa and Watanabe. (C.J.G.)

14299

AXIAL VECTOR CURRENT CONSERVATION IN WEAK INTERACTIONS. Yoichiro Nambu (Univ. of Chicago). Phys. Rev. Letters 4, 380-2(1960) Apr. 1.

It is suggested that there may not be a strict axial pseudovector current conservation in weak interactions but that an approximate conservation exists which becomes rigorous in the limit $q^2 >> M_\pi^2$, M_π being the pion mass. (C.J.G.)

14300

A NEW METHOD OF EVALUATING THE PARAMETERS OF MULTIPLE COULOMB SCATTERING. Z. Al'per and E. Friedlander (Inst. of Nuclear Physics, Academy of Sciences, Rumanian SSR). Pribory i Tekh. Ekspt. No. 6, 39-41(1959) Nov.-Dec. (In Russian)

The method suggests calculating the total number of N sagitta and N* sagitta exceeding the assigned value δ^* instead of the mean arithmetic sagitta ordinarily used for calculating the parameter of multiple Coulomb scattering. (R.V.J.)

14301

SPECTRAL DISTRIBUTIONS OF PRIMARY AND SCATTERED 140 Kvp X-RAYS. D. V. Cormack and D. G. Burke (Univ. of Saskatchewan, Saskatoon and Saskatoon Cancer Clinic Saskatchewan). Radiology 74, 743-52(1960) May.

A scintillation spectrometer was used to measure both primary and scattered radiation spectra from a Picker Vanguard machine operating at 140 kvp. The half value layer calculated from the primary spectrum was 1.45 ± 0.1 mm Al as compared with a measured value of 1.33 ± 0.1 mm Al. Scattered spectra were measured in water on the central axes of circular fields 50 and 300 sq cm in area and at depths of 2, 5, and 10 cm. Measurements were made at angles between 15 and 140° and integrated graphically to give the complete scattered spectra. Primary and scattered spectra were normalized to an incident primary dose of 100 r with the aid of published depth dose data. Effective half-value layers of primary, scattered, and total radiation are tabulated. (auth)

14302

NEW EXPERIMENTAL DATA ON π- AND μ-MESON DECAY. A. O. Vaisberg. Uspekhi Fiz. Nauk 70, 429-87(1960) Mar. (In Russian)

An analysis is made of experimental data developed during the last two years on the properties of "free" π and μ mesons. The mass and lifetimes of π and μ mesons, electron spectra in $\pi \rightarrow \mu \rightarrow e$ decay, spatial electron distribution assymetry, lepton spirality and lepton charge conservation law, μ-meson magnetic moment, π-meson electron decay, radiation decay of π and μ mesons, and depolarization of μ mesons are discussed. 144 references. (R.V.J.)

14303

POLARIZATION OF (d–d) NEUTRONS. P. S. Otstavnov. Zhur. Ekspt'. i Teoret. Fiz. 37, 1815-17(1959) Dec. (In Russian)

The degree of (d–d) neutron polarization was measured at $\varphi = 115°$ (laboratory system) as a function of deuteron energies. The measurements were made using a cascade generator to produce 400 to 1000 kev deuterons for bombarding a heavy ice target. A gaseous Ne^4 diffuser, placed 170 cm from the target, was used as neutron detector. It is shown that d–d neutron polarization increases with the absolute magnitude of deuteron energy. The growth and the magnitude are similar to (d–d) neutron measurements emitted at the angle $\varphi = 47$ to 49°. (R.V.J.)

14304

ON THE μ MESON AND ELECTRON MASS. Ya. B. Zel'dovich (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Ekspt'. i Teoret. Fiz. 37, 1817-18(1959) Dec. (In Russian)

The μ meson and electron masses were determined on the basis of electromagnetic and weak interactions. (R.V.J.)

14305

DEPOLARIZATION OF MUONS IN μ MESIC ATOMS WITH DEFORMED NUCLEI. D. F. Zaretskiĭ and V. M. Novikov. Zhur. Ekspt'. i Teoret. Fiz. 37, 1824-5(1959) Dec. (In Russian)

A supplementary depolarization induced in μ mesic atoms with deformed nuclei by muon interactions with the nuclear deformation was analyzed for the case of even-even nuclei. (R.V.J.)

14306

FORM FACTOR AND PROBABILITY OF Λ PARTICLE LEPTON DECAY. Tso-hsiu Ho (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Ekspt'. i Teoret. Fiz. 37, 1825-7(1959) Dec. (In Russian)

The influence of strong interaction form factors on the probabilities of Λ hyperon β and μ decay was evaluated. (R.V.J.)

14307

ON THE EXISTENCE OF PARTICLES WITH MASSES OF $2m_e \leq \mu \leq 25m_e$. A. N. Gorbunov, V. M. Spiridonov, and P. A. Cerenkov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Ekspt'. i Teoret. Fiz. 38, 69-73 (1960) Jan. (In Russian)

Experiments were made with a Wilson chamber in a magnetic field for the purpose of detecting the possible generation of particles of mass 2 to 25 m_e in a lead target placed in the 265 Mev bremsstrahlung beam of the Physics Institute synchrotron. It is shown that if particles of mass from 2 to 25 m_e, spin ½, and life time over 10^{-9} sec exist, the cross section of their production in electromagnetic interactions is more than two orders smaller than the values expected. (auth)

14308

INTEGRAL TRANSFORMATIONS OF THE I. S. SHAPIRO TYPE FOR ZERO MASS PARTICLES. L. G. Zastavenko and Kuang-chao Chou (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Ekspt'. i Teoret. Fiz. 38, 134-9 (1960) Jan. (In Russian)

An expansion is presented for a representation according to which the wave function of a zero mass and arbitrary spin particle transforms into irreducible representations of the proper Lorentz group. (auth)

14309

ON THE POSSIBILITY OF PASSAGE OF ELECTROMAGNETIC WAVES THROUGH METALS IN A STRONG MAGNETIC FIELD. O. V. Konstantinov and V. I. Perel

(Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 38, 161-4(1960) Jan. (In Russian)

It is shown that an electromagnetic wave travelling along a magnetic field can penetrate through a metal plate held perpendicular to the field provided the Larmor frequency exceeds the wave frequency and is much higher than the collision frequency, and the Larmor electron radius is smaller than the length of the wave in the metal. (auth)

14310

ON THE BEHAVIOR OF THE FERMION SPIN AT THE ELASTIC SCATTERING. A. A. Sokolov and M. M. Kolesnikova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 165-71(1960) Jan. (In Russian)

Fermion spin behavior during elastic scattering is investigated in its dependence upon the type of the interaction. In the ultrarelativistic case (or in case of the zero rest mass particles) it is shown that the angle between the spin pseudovector and the momentum remains unchanged for the V- and A-interactions while for S, P, and T-interactions this angle is changed by 180°. (auth)

14311

GREEN'S FUNCTION IN THE MODEL OF SCALAR CHARGED MESONS WITH A FIXED SOURCE. B. M. Barbashov and G. V. Efimov (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 198-200(1960) Jan. (In Russian)

A new method of calculating the Green's function, differing from the perturbation theory method, is given and illustrated for the case of a static nucleon interacting with charged scalar mesons. (auth)

14312

NUCLEON SCATTERING OF GAMMA QUANTA NEAR THE MESON PRODUCTION THRESHOLD. L. I. Lapidus and Kuang-chao Chou (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 201-11 (1960) Jan. (In Russian)

Elastic scattering of γ rays near the single meson production threshold is examined with the aid of dispersion relations. It is shown that if meson production in the s-state is taken into account, perceptible nonmonotonies result in the energy dependence of the scattering amplitudes, cross sections, and other observable quantities near the reaction threshold. The scattering amplitudes, differential and total cross sections of elastic scattering of nonpolarized and polarized γ-quanta on protons, as well as the polarization of recoil protons above the production threshold, were calculated under certain assumptions concerning the analysis of photoproduction in a γ-quantum energy range of up to 220 Mev. (auth)

14313

PERIPHERAL NUCLEON INTERACTIONS AT ENERGIES OF 9 BeV. I. M. Dremin and D. S. Chernavskii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 229-32(1960) Jan. (In Russian)

The peripheral interaction is considered of two nucleons (9 Bev energy) involving the exchange of one pion. The cross section of such processes is estimated. It was found also that during such peripheral interactions excited nucleons are in a state with an isospin of $^3/_2$. (auth)

14314

CONCERNING THE STRUCTURE OF THE GREEN'S FUNCTION OF A PHOTON. D. A. Kirzhnits, V. Ya. Fainberg, and E. S. Fradkin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 239-42(1960) Jan. (In Russian)

It is shown that the so-called Redmond procedure is not unambiguous. This conclusion does not change when the requirements of renormalization invariance are taken into account. (auth)

14315

ON MESON-NUCLEON SCATTERING AT LARGE ORBITAL MOMENTS. A. D. Galanin. Zhur. Eksptl'. i Teoret. Fiz. 38, 243-7(1960) Jan. (In Russian)

Pion-nucleon-scattering phases at large orbital moments are described in terms of the $\pi\pi$-interaction constant. If the obtained results can be extended to the case of $l = 2$ with the assumption that at low energies the $\pi\pi$-scattering amplitude is not resonant, disagreement with experimental data is observed. (auth)

14316

REVERSIBLE DISPERSION RELATIONS FOR π MESON PHOTOPRODUCTION ON NUCLEONS. N. F. Nelipa and V. A. Tsarev (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 259-60 (1960) Jan. (In Russian)

Reversible dispersion relations for π-meson photoproduction on nucleons, for the case where a non-physical region is adjacent to the region of a continuous spectrum, were derived using the method applied by V. Z. Blank (Zhur. Eksptl'. i Teoret. Fiz. 33, 1251(1957)). (R.V.J.)

14317

DIRECT ELECTRON-POSITRON PAIR PRODUCTION BY ELECTRONS. V. A. Tumanyan. Zhur. Eksptl'. i Teoret. Fiz. 38, 264-5(1960) Jan. (In Russian)

Twenty-nine tridents were recorded in studies of photon components of two nuclear high-energy ($\lesssim 10^{13}$ev) interactions and in three isolated electron-photon showers. The electron pair energies, determined by photon components, were found by measuring the relative multiple scattering. In electron-photon showers the primary pair energy was determined by the data on electron cascade longitudinal development. The data derived for the cross section in direct electron-positron pair formation by electrons are in good agreement, up to 100 Mev initial electron energy, with the quantum hydrodynamic predictions. (R.V.J.)

14318

PHOTOPRODUCTION OF π^+ MESONS ON HYDROGEN NEAR THE THRESHOLD. E. G. Gorzhevskaya, V. M. Popova, and F. R. Yagudina (Lebedev Inst. of Physics, Acadamy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 276-8(1960) Jan. (In Russian)

The behavior of square elements in π^+ meson photoproduction near threshold was analyzed. The cross section of π^+ photoproduction on hydrogen near threshold was correlated with the cross section of π^- photoproduction on neutrons. The data were compared with the meson theory prediction of the magnitude of σ^-/σ^+ near threshold. The derived magnitude $\sigma^-/\sigma^+ = 1.3 \pm 0.3$ is in good agreement with theory. (R.V.J.)

14319

CROSS SECTION OF Ω^- PARTICLE FORMATION IN REACTION $\pi^- + p \rightarrow \Omega^- + 3K$ AT 8 Bev AND $p + \bar{p} \rightarrow \Omega + \bar{\Omega}$ AT 4 Bev. Ting-ch'ang Hsien (Joint Inst. for Nuclear Research Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 289-90 (1960) Jan. (In Russian)

The cross section of Ω^- production in (π^-,p) at 8 Bev and p-$\bar{p}$ at 4 Bev is evaluated within the limits of statistical theory. (R.V.J.)

14320

REACTION $d + d \rightarrow \pi^0 + He^4$ WITH 400 Mev DEUTERONS. Yu. K. Akimov, O. V. Savchenko, and L. M. Soroko (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 304-6(1960) Jan. (In Russian)

Data are presented on the reaction $d + d \rightarrow \pi^0 + He^4$ at a deuteron energy of 400 Mev. The yields of α particles from heavy polyethylene and carbon were used for comparisons. Measurements at 5.6° indicate, with an accuracy order of 90%, the total cross section of the reaction to be $\sigma_T < 1 \times 10^{-31}$ cm^2. Evaluation of the reaction total cross section indicates that an isotropically scalar π^0 with (135^{+15}_{-35}) Mev mass does not exist. Measurements were also made of the differential cross section of $d + d \rightarrow He^3 + n$ at 5.6° (laboratory) which in the center of mass system was $(d\sigma/d\Omega)(15.5°) = (3.8 \pm 0.5) \times 10^{-25}$ cm^2/sterad. (R.V.J.)

14321

ON PERIPHERAL COLLISIONS OF HIGH ENERGY NUCLEONS. V. M. Maksimenko (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 306-7(1960) Jan. (In Russian)

The model of fast neutron interactions with large impact parameters developed by I. E. Tanim indicated that the interactions result in one pion exchange and one or two nucleon excitations to isobar states followed by their disintegration. Moreover, it is postulated that an interaction with isotopic spin $\frac{1}{2}$, which is interpreted as a second nucleon isobar level, Y, is possible along with isobar excitation $(\frac{3}{2}, \frac{3}{2})$, X. The second isobar, Y, disintegrates along the following scheme (where the probability ω is evaluated with statistical weight by assigning to isobar Y the mass 1.64 $m_{nucl.}$, isotopic spin $\frac{1}{2}$, and linear dimensions of $\hbar/\mu c$ order): $Y \rightarrow N + \pi$, $\omega_1 = 0.324$; $Y \rightarrow X + \pi$, $\omega_2 = 0.418$; and $Y \rightarrow N + 2\pi$, $\omega_3 = 1 - \omega_1 - \omega_2 = 0.258$. The decay producing strange particles were not considered. (R.V.J.)

14322

SINGLE SCATTERING OF 10-30 MeV μ^--MESONS ON CARBON. A. I. Alikhanyan, V. G. Kirillov-Ugryumov, L. P. Kotenko, E. P. Kuznetsov, and A. V. Samoilov. Zhur. Eksptl'. i Teoret. Fiz. 38, 387-93(1960) Feb. (In Russian)

Single scattering of μ^--mesons in a propane bubble chamber was measured for μ^--mesons possessing energies between 10 and 30 Mev. The differential angular distribution was found to be satisfactorily described by a Mott scattering curve if the finite size of the nucleus was taken into account. The experiment showed that the cross section for anomalous scattering (if it exists) through an angle of >45° cannot exceed 1.25×10^{-28} cm^2 per nucleon for the energies under consideration and does not exceed 0.7×10^{-28} cm^2 per nucleon for scattering through an angle >90°. Not one case of μ^--decay of the $\mu^- \rightarrow e^+ + e^- + e^-$ type was detected in the 60000 stoppage events. (auth)

14323

INVESTIGATION OF ELASTIC SCATTERING OF π^--MESONS WITH MOMENTUM 6,8 Bev/c ON PROTONS IN A PROPANE BUBBLE CHAMBER. Kan-chang Wang, Tsu-tzien Wang, Da-tsao Din, V. G. Ivanov, Yu. V. Katyshev, E. N. Kladnitskaya, L. A. Kulyukina, Ting-ty Nguen, A. V. Nikitin, S. Z. Otvinovskii, M. I. Solov'ev, R. Sosnovskii, and M. D. Shafranov. Zhur. Eksptl'. i Teoret. Fiz. 38, 426-31 (1960) Feb. (In Russian)

The elastic scattering of 6.8 Bev/c negative pions on protons was studied in a propane bubble chamber. The total and differential cross sections of the elastic scattering were determined, based on 213 events. The total π^--p interaction cross section was estimated to be 30 ± 5 mb. The results of the elastic scattering experiment were consistent with the optical model analysis of the proton as a uniform sphere with sharp boundaries of $R = 1.05 \times 10^{-13}$ cm, $K = 0.71 \times 10^{13}$ cm^{-1}, and $k_1 = 0$. (auth)

14324

CHARGED π-MESON PRODUCTION IN THE INTERACTION BETWEEN 9 Bev PROTONS AND PHOTOGRAPHIC EMULSION NUCLEI. N. P. Bogachev, S. A. Bunyatov, T. Vishki, Yu. P. Merekov, V. M. Sidorov, and V. A. Yarba. Zhur. Eksptl'. i Teoret. Fiz. 38, 432-40(1960) Feb. (In Russian)

Nuclear disintegrations produced in photographic emulsions by 9 Bev protons and possessing not less than three fast particles were studied. The charged π-meson energy spectrum was measured up to 540 Mev and extrapolated to the high energy region. The angular distributions of fast π-mesons and protons in the laboratory coordinate system were obtained. The mean numbers of π-mesons and fast protons per disintegration were found. The fraction of primary proton energy transferred to π-mesons is estimated. The ratio of the numbers of π- and K-mesons in the velocity range $\beta = 0.5$ to 0.8 was derived. (auth)

14325

ELASTIC SCATTERING OF 300 Mev π^--MESONS ON HYDROGEN. I. M. Vasilevskiĭ and V. V. Vishnyakov. Zhur. Eksptl'. i Teoret. Fiz. 38, 441-4(1960) Feb. (In Russian)

The elastic scattering of 300 Mev π^--mesons on hydrogen was studied using a hodoscope in which the counters were fed by pulsed voltage. On the assumption that elastic scattering is mainly due to S- and P-waves, an equation was derived for the angular distribution. (auth)

14326

2.8 Bev/c MOMENTUM ANTIPROTON CHANNEL. N. M. Viryasov, A. S. Vovenko, G. G. Vorobev, A. D. Kirillov, Hu-ying Kim, B. A. Kulakov, A. L. Lyubimov, Yu. A. Matulenko, I. A. Savin, E. V. Smirnov, L. N. Strunov, and I. V. Chuvilo. Zhur. Eksptl'. i Teoret. Fiz. 38, 445-8(1960) Feb. (In Russian)

The separation of antiprotons possessing a momentum of 2.8 Bev/c is described. Data on the relative frequency of generation of antiprotons and π-mesons in Be and Cu were determined. (auth)

14327

PRODUCTION OF π-MESONS IN pd-COLLISIONS AND INTERNUCLEAR MOTION OF NUCLEONS. Yu. D. Prokoshkin. Zhur. Eksptl'. i Teoret. Fiz. 38, 455-61(1960) Feb. (In Russian)

It is shown that the energy dependence of the cross sections for the production of π-mesons in nucleon-deuteron collisions and the energy spectra of π-mesons can be calculated with a rather good accuracy from data on free nucleon-nucleon collisions. In the energy range from the threshold of meson production to ~700 Mev, the influence of the nucleon binding in the deuteron mainly leads to a change in the magnitude of the cross sections as a result of internuclear motion of the nucleons. The effective momentum distribution of nucleons in the deuteron was found. (auth)

14328

ON THE NONLINEAR THEORY OF ELEMENTARY PARTICLES. D. F. Kurdgelaidze. Zhur. Eksptl'. i Teoret. Fiz. 38, 462-74(1960) Feb. (In Russian)

The energy and momentum of spinor fields with nonlinear pseudovector and scalar corrections were calculated from solutions of the wave type. The nucleon mass, $k_0 l = \sqrt{2}\,\pi^{3/4} \approx 7.84$, was derived by semi-classical quantization. The dependence of the field energy on the degree of nonlinearity was established. From the nonlinear spinor equation a nonlinear equation was derived which, under certain assumptions, can be reduced to a nonlinear meson equation of the Klein–Gordon type. Homologic invariance of nonlinear meson and spinor field equations is considered. (auth)

14329

NUCLEON-NUCLEON SCATTERING IN TWO-MESON AP-

PROXIMATION AT LARGE ORBITAL MOMENTS. A. D. Galanin, A. F. Grashin, B. L. Ioffe, and I. Ya. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 38, 475-88(1960) Feb. (In Russian)

A method for the calculation of the nucleon-nucleon scattering amplitude in two-meson approximation at large orbital moments is described. Concrete calculations were made for the singlet amplitude in non-relativistic approximation at orbital moments of $1 \ll l \ll 4m^2/\mu^2$ (m is the nucleon mass and μ is the meson mass). The results indicate that F and G phases with nucleon energies <200 Mev can be derived with good accuracy from the one-meson approximation. (auth)

14330

ON THE STATISTICAL THEORY OF MULTIPLE PRODUCTION OF PARTICLES. A. I. Nikishov. Zhur. Eksptl'. i Teoret. Fiz. 38, 509-12(1960) Feb. (In Russian)

Assuming that equilibrium does not set in during a collision, the statistical theory was employed for estimation of the mean values of the squares of the matrix elements. Satisfactory agreement with the experiments was obtained for the multiplicity, charge state, and momentum distributions irrespective of the charge of the particles. (auth)

14331

RADIATIVE CORRECTIONS TO THE PHOTOPRODUCTION AND SINGLE PHOTON ANNIHILATION OF PAIRS. S. Ya. Guzenko and P. I. Fomin. Zhur. Eksptl'. i Teoret. Fiz. 38, 513-17(1960) Feb. (In Russian)

General formulas were obtained for radiative corrections to photoproduction and single photon annihilation of electron-positron pairs. Some limiting cases are considered. (auth)

14332

INTERFERENCE OF FORM FACTORS IN LEPTONIC DECAY OF HYPERONS. V. M. Shekhter. Zhur. Eksptl'. i Teoret. Fiz. 38, 534-40(1960) Feb. (In Russian)

It is shown to be possible to deduce the energy dependence of the coefficients before the products of various form factors in the expression for the probability of leptonic decay of hyperons. It is demonstrated how to predict when part of these coefficients will vanish by making use of invariance of the four-fermion interaction matrix element under some formal transformations, no straightforward calculations being required. (auth)

14333

ON THE POSSIBILITY OF DETERMINATION OF FORM FACTORS IN LEPTONIC DECAY OF HYPERONS. V. P. Belov, B. S. Mingalev, and V. M. Shekhter. Zhur. Eksptl'. i Teoret. Fiz. 38, 541-52(1960) Feb. (In Russian)

The energy correlation and asymmetry of emission of particles produced in leptonic decay of hyperons and the polarization of the emitted nucleons or secondary hyperons were calculated taking into account all six form factors of the decay V-A interaction. A method of comparison of the theoretical formulas with the experimental data is suggested which permits the determination of the form factors. A similar calculation is presented when all five types of decay interaction are retained and the form factors are neglected. (auth)

14334

ON THE POSSIBILITY OF DETERMINING THE SCATTERING AMPLITUDES OF UNSTABLE PARTICLES AT ZERO ENERGY. V. N. Gribov. Zhur. Eksptl'. i Teoret. Fiz. 38, 553-69(1960) Feb. (In Russian)

The possibility of determining the scattering amplitudes of unstable particles by analyzing the energy and angular distributions of reactions in which they are produced is discussed. Reactions involving the formation of two particles $(\pi + N \to \Lambda + K, \Sigma + K)$ and three particles $(N + N \to N + \Lambda + K)$ of which two interact at low energy are considered. (auth)

14335

DISPERSION RELATION ANALYSIS OF π-MESON PHOTOPRODUCTION DATA IN THE NEAR THRESHOLD REGION. A. M. Baldin. Zhur. Eksptl'. i Teoret. Fiz. 38, 579-87 (1960) Feb. (In Russian)

It was found for the near threshold region that data on photoproduction of π-mesons can be directly compared with the dispersion relations. This method of analysis is applied to experimental data on photoproduction of π^0-, π^+-, and π^--mesons. The cause of the serious discrepancy between the predictions of the dispersion relations and the experimental data found was investigated. Experiments are suggested to ascertain if this discrepancy is the result of a large contribution of high energy regions to the dispersion integrals. (auth)

14336

PROPAGATION OF ELECTROMAGNETIC WAVE IN WAVEGUIDES FILLED WITH PLASMA. V. E. Golant and A. P. Zhilinskii (Kalinin Leningrad Polytechnic Inst.). Zhur. Tekh. Fiz. 30, 15-24(1960) Jan. (In Russian)

Perturbation theory was used in investigating electromagnetic wave propagation in waveguides filled with a-c plasma. The phase shift and attenuation induced by plasma are calculated in first and second perturbation theory approximation. (tr-auth)

14337

SCATTERING OF ELECTROMAGNETIC WAVES BY FREE ELECTRONS IN AN INTENSE MAGNETIC FIELD. L. E. Gurevitch and S. T. Pavlov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 30, 41-3(1960) Jan. (In Russian)

A mathematical analysis is given of electromagnetic wave scattering by free electrons in a strong magnetic field. (R.V.J.)

14338

ANALYSIS OF SYSTEMATIC MISTAKES DURING THE INVESTIGATION OF SMALL ANGLE SCATTERING. L. G. Filippenko (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 30, 57-62(1960) Jan. (In Russian)

Systematic errors introduced in calculations of differential cross sections by the limited resolving power of the apparatus and by initial divergence of the primary beam were analyzed. Methods for evaluating the errors and experimental verifications of the efficiency of these methods are discussed. (tr-auth)

14339

ON THE ACCURACY AND APPLICATION LIMITS OF THE DIFFUSION APPROXIMATION FOR THE SOLUTION OF THE γ-RAY SCATTERING PROBLEMS. G. M. Voskoboinikov (Inst. of Geophysics, Urals Div. of the Academy of Sciences, USSR). Zhur. Tekh. Fiz. 30, 90-5(1960) Jan. (In Russian)

Results obtained with approximations developed for γ scattering, describing multiple quanta as limited half-life particles, are in good agreement with experimental soft-ray data. The experimental values for strong radiation from Co^{60} are larger than the calculated values. However, the relative intensity variations, when related to variations in composition and density of the medium, are satisfactorily described by the calculations. (tr-auth)

14340

NUMERICAL DEFINITION OF TRAJECTORY OF CHARGED RELATIVISTIC PARTICLES IN ELECTRIC

AND MAGNETIC FIELDS. N. I. Shtepa (Osk State Pedagogical Inst., USSR). Zhur. Tekh. Fiz. 30, 121-4(1960) Jan. (In Russian)

An extrapolation method, applied directly to a system of second-order differential equations, was used for determining the trajectories of charged relativistic particles in electric and magnetic fields. The recurring evaluation ratios and a numerical example of the problem are presented. (tr-auth)

14341

National Bureau of Standards, Washington, D. C.
ENERGY DISSIPATION BY FAST ELECTRONS. L. V. Spencer. National Bureau of Standards Monograph 1. 72p. $0.45(GPO).

Tabulations are given of the energy dissipated by fast electrons at different distances from monoenergetic electron sources, for plane perpendicular and point isotropic sources. A summary of the theoretical methods and data utilized and a table of spatial moments are also included. (auth)

14342

SCATTERING OF DEUTERONS AND HEAVIER PARTICLES. H. S. Melkanoff (Univ. of California, Los Angeles). p.207-15 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Diffuse optical model analyses of the elastic scattering of alpha particles by various elements at a number of energies, nitrogen by nitrogen ions, and deuterons by various nuclei at several energies are discussed. Diffuse surface optical model parameters are given for deuteron scattering at 13.5 and 15 Mev. (W.D.M.)

14343

SCATTERING OF K MESONS. D. H. Stork (Univ. of California, Los Angeles). p.216-27 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

The scattering and interactions of positive and negative K mesons in nuclear emulsions are discussed. The various types of information which can be obtained from the studies in nuclear emulsions are considered. It is shown that with the present statistics good fits can be obtained with the diffuse surface optical model. (W.D.M.)

14344

SCATTERING OF PI MESONS. J. Rainwater (Columbia Univ., New York). p.228-61 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Work at Nevis Cyclotron Lab. on negative pion scattering at 80 Mev is described. A transmission arrangement of the scatterer was used. The energy definition is well enough determined to separate between the elastic scattering and inelastic scattering with the excitation of the nucleus of the order of 5 Mev. (W.D.M.)

Nuclear Properties and Reactions

14345 BNL-205

Brookhaven National Lab., Upton, N. Y.
A METHOD FOR MEASURING THE U^{239} FISSION CROSS SECTION. M. Clark. June 1952. Decl. Feb. 24, 1960. 21p. OTS.

A method of measuring the fission cross section of U^{239} is proposed. U^{238}, highly purified with respect to U^{235}, is introduced as some suitable compound into a small, very fast ion chamber. The assembly is irradiated with thermal neutrons. Capture of a neutron by U^{238} forms U^{239}, and the two are to be separated by an appropriate Szilard-Chalmers reaction. The U^{238} compound is removed and replaced by a fast-counting gas. The unit is then irradiated in a known flux of thermal neutrons. The fission rate of the material in the chamber at first decreases because of U^{239} decay and then increases by reason of Pu^{239} formation and subsequent fission. This transient may be used to discriminate against the fission rate of U^{235} or of U^{238}. It is also utilized to measure the initial number of U^{239} atoms present. Since U^{238} undergoes fission with fast neutrons, the chamber must be exposed to a highly thermalized flux of neutrons. Only moderate amounts of graphite will be needed for this; nevertheless, it is not impossible that this requirement may prevent use of a high flux. A high Szilard-Chalmers enrichment, for which credit is not taken in the calculations, will most decidedly mitigate all of the above problems. (auth)

14346 CF-60-4-30

Oak Ridge National Lab., Tenn.
A SIMPLE FORMULA FOR COMPUTING FISSION PRODUCT THERMAL CROSS SECTIONS AND RESONANCE INTEGRALS. C. W. Nestor. Apr. 7, 1960. 14p. OTS.

A simple formula for computing fission product thermal cross sections and resonance integrals as a function of exposure is presented. Results determined by this formula agreed with those of previously published calculations to within four per cent. The formula was used in calculating the effective cross section and resonance integral as functions of fuel-processing cycle time in fluid-fueled reactors. (auth)

14347 CRP-881

Atomic Energy of Canada Ltd., Chalk River, Ont.
He^3 INDUCED REACTIONS: RESULTS AND TECHNIQUES. D. A. Bromley and E. Almqvist. 1959. 394. (AECL-950). AECL.

A compilation of He^3 induced reactions is presented. References to all published work on these reactions appearing prior to June 1959 were surveyed, and some later references are included. The survey also includes information on experimental techniques, reaction mechanisms, nuclear spectroscopy, and suggested experiments. (J.R.D.)

14348 NP-8560

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
RADIATIONLESS TRANSITIONS IN HEAVY μ-MESOATOMS. M. Ya. Balats, L. N. Kondratyev, L. G. Landsberg, P. I. Lebedev, Yu. V. Obukhov, and B. Pontecorvo. 1960. 9p. (P-448).

Reported at the IX International Conference on High Energy Physics, Kiev, 1959.

Spectra of x rays, emitted by μ-mesic atoms of uranium and lead, were investigated by means of a scintillation spectrometer. It was shown that the intensity of 2P-1S radiative transitions in mesouranium, normalized to one stopped muon, is considerably less than in mesolead. The existence of this mechanism of mesoatom transitions, in which the relevant energy is directly transferred to the nucleus was experimentally proved. (auth)

14349 UCRL-Trans-495(L)(Pts.I and II)
PHOTONUCLEAR REACTIONS AND GIANT RESONANCE. PARTS I AND II. V. De Sabbata. Translated by Mary D. Kilpatrick from Nuovo cimento (10) 5, Suppl. No. 1, 243-66(1957); Ibid. (10) 11, Suppl. No. 2, 225-314(1959). 98p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 11455 and NSA, Vol. 13, as abstract 13915.

14350
NUCLEAR MODELS. Riek van Wageningen (Univ. of California, Berkeley). Am. J. Phys. 28, 425-36(1960) May.

A summary is given of the development of nuclear models, both for the description of structure and of scattering and reaction processes. The treatment is qualitative, and follows mainly the historical development. Models discussed are the liquid drop model, the potential well model for nuclear reaction processes, the compound nucleus model for nuclear reactions, and the shell model. Then a summary and comparison is made, followed by a brief sketch of the unified or collective model, which is a unification of the liquid drop and the shell model. The nuclear optical model or complex potential well model is discussed. (auth)

14351
ELECTRON-NUCLEUS HYPERFINE INTERACTION IN ATOMS. Richard A. Ferrell (Univ. of Maryland, College Park). Am. J. Phys. 28, 484-6(1960) May.

It is pointed out that the so-called "hyperfine interaction" between the magnetic moment of a nucleus and the spins of the surrounding electrons is completely classical in origin. Quantum mechanics is irrelevant and not necessary to the understanding of this coupling. A simple derivation, based only on classical static magnetism, is given of Fermi's formula for the interaction energy. (auth)

14352
TRANSITIONS FOLLOWING THE DECAY OF Se^{75}. Mathilde de Croës and Gunnar Bäckström. Arkiv Fysik 16, 567-79(1960). (In English)

The conversion electron spectrum and the gamma ray spectrum of the electron capture decay of Se^{75} were reinvestigated by means of a double focusing spectrometer. Conversion coefficients were determined relative to the 279 kev transition in Tl^{203} in order to investigate an EO admixture which, according to previous works, seemed to exist in the 264 kev transition. The multipolarity was, however, found to be pure M1, with a maximum EO admixture of 6×10^{-3}. The conversion coefficients generally support previous spin assignments. Transition energies also support all features of a published decay scheme. Two additional transitions were found which are not accommodated by the known levels. An electron-gamma coincidence experiment was made in an attempt to locate these transitions. (auth)

14353
THE NEUTRON-DEFICIENT ISOTOPE Ho^{155}. B. Dalkhsuren, I. Yu. Levenberg, Yu. V. Norseev, V. N. Pokrovskiĭ, and S. S. Khainatskiĭ. Atomnaya Energ. 8, 248(1960) Mar. (In Russian)

The existence of Ho^{155} with a half life of 46 ± 3 min was confirmed. Its γ emission is ~140 kev. (R.V.J.)

14354
PROPERTIES OF THE GROUND STATE OF DEFORMED NUCLEI. Christiane de Laet. Compt. rend. 250, 2350-52(1960) Mar. 28. (In French)

The Gottfried results on the stability of spheroidal deformations are confirmed. The Geilikman results do not appear applicable to the ground state of even-even nuclei. (tr-auth)

14355
SEARCH FOR E0 TRANSITION IN ZINC-68. M. K. Ramaswamy (Ohio State Univ., Columbus). Indian J. Phys. 34, 98-9(1960) Feb.

The internal positron spectrum from the 2.3 Mev level in Zn^{68} was examined for internal conversion electrons by means of an anti-coincidence arrangement. The data gave an upper limit of $5 \pm 25 \times 10^{-9}$ conversion electrons per Ga^{68} decay; the expected yield was calculated to be 84×10^{-9} for the 0+ level from the single-particle model. This supports other work which shows the 2.3 Mev level to be 2+. (D.L.C.)

14356
IDENTIFICATION OF Xe^{142} AND MEASUREMENT OF ITS CUMULATIVE YIELD FROM THERMAL-NEUTRON FISSION OF U^{235}. K. Wolfsberg, D. R. Nethaway, H. P. Malan, and A. C. Wahl (Washington Univ., St. Louis). J. Inorg. & Nuclear Chem. 12, 201-5(1960) Feb.

Xe^{142} was identified as a product of the thermal-neutron fission of U^{235} by determination of 85 min La^{142} in the active deposit of highly emanating uranyl stearate. The half-life of Xe^{142} is ~1.5 sec, and its cumulative yield in fission is 0.059 of the total 142-chain yield. The cumulative yield of Xe^{141} was redetermined to be 0.205 of the 141-chain yield, in agreement with the previously reported value of 0.21 ± 0.02. The Xe^{142} yield is compared with values predicted by various postulates of nuclear charge distribution in fission. The mass number of the 85 min La was proven to be 142 by its formation from the Ce^{142}-La^{142} reaction. (auth)

14357
SHORT-LIVED BROMINE AND SELENIUM NUCLIDES FROM FISSION. J. E. Sattizahn, J. D. Knight, and M. Kahn (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 12, 206-22(1960) Feb.

A 6.0 ± 0.2 min bromine activity was found in fission products and in rubidium bombarded with d-t neutrons. Experiments with enriched Rb^{85} and Rb^{87} support its assignment as an isomer of Br^{84}. β- and γ-scintillation counting with 100-channel pulse analysis indicate β groups of 0.8 ± 0.1 Mev (20%), 1.9 ± 0.2 Mev (72%), and possibly 3.2 Mev (~8%), plus prominent γ rays of 0.44 ± 0.01 Mev (68%), 0.88 ± 0.01 Mev (75%), 1.46 ± 0.02 Mev (75%), and 1.89 ± 0.03 Mev (16%). The U^{235} thermal fission yields of the 6.0 min Br^{84} and the 31.7 min Br^{84} are 0.019 ± 0.003% and 0.92 ± 0.06%, respectively. By rapid separation of selenium from fission products and subsequent milking of the bromine daughters the half-lives of Se^{84} and Se^{85} were measured as 3.3 ± 0.2 min and 39 ± 4 sec, respectively. The 6.0 min Br^{84} does not appear to grow from selenium. The experiments also produced evidence for a 16 ± 3 sec selenium parent of a 1.0 min bromine activity which is probably Br^{87} (auth)

14358
A NEW FISSION PRODUCT: Ga^{74}. J. A. Marinsky and E. Eichler (Oak Ridge National Lab., Tenn.). J. Inorg. & Nuclear Chem. 12, 223-7(1960) Feb.

The 8 min Ga^{74} was separated from the fission products of U^{235}. The gallium activity was characterized as Ga^{74} by comparison of its γ-ray spectrum with that obtained from (n,p)-produced Ga^{74}. Chemical separation of the Ga^{74} was effected by a combination of extraction, volatilization, ion-exchange, and precipitation steps. Its fission yield was determined to be about 3.4×10^{-4}%, in good agreement with the yield expected for mass 74 from interpolation of the smooth mass-fission yield curve for U^{235}. (auth)

14359

HALF-LIVES OF Pm^{149} AND Pm^{151}. L. R. Bunney, J. O. Abriam, and E. M. Scadden (U. S. Naval Radiological Defense Lab., San Francisco). J. Inorg. & Nuclear Chem. 12, 228-33(1960) Feb.

New half-life values were obtained for Pm^{149} and Pm^{151}. Half-life values were found to be 53.09 ± 0.09 hr for Pm^{149} and 28.40 ± 0.04 hr for Pm^{151}. γ scintillation spectrometry showed only one prominent γ-ray in the decay of Pm^{149} at 286 kev. This γ-ray is present in about 2% abundance. Pm^{151} exhibited prominent γ rays at 71, 108, 170, 342, and 442 kev. (auth)

14360

THE SPECIFIC ACTIVITY AND HALF-LIFE OF Np^{237}. F. P. Brauer, R. W. Stromatt, J. D. Ludwick, F. P. Roberts, and W. L. Lyon (General Electric Co., Richland, Wash.). J. Inorg. & Nuclear Chem. 12, 234-5(1960) Feb.

The specific activity of Np^{237}, as determined by absolute α counting, was found to be 1562 ± 7 disintegrations per min per μg or a half life of $2.14 \pm 0.01 \times 10^{6}$ years. The aliquots of Np^{237} for counting were taken from a standard solution prepared from neptunium metal and checked by coulometric titration. (auth)

14361

TWO NEW NEUTRON-DEFICIENT TERBIUM ACTIVITIES. K. S. Toth and J. O. Rasmussen (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 12, 236-40(1960) Feb.

A series of C^{12} bombardments on Pr^{141} resulted in the discovery of two new activities. The first, with a 70 min half life, is believed to be Tb^{148} and has two γ-rays, 780 and 1120 kev, following its decay. The 780 kev γ ray is postulated to be the transition from the first excited level to the ground state in the even-even nucleus, Gd^{148}. The second activity has a half life of 24 min and has a 305 kev γ ray following its decay. It is probably Tb^{147}, though this has not been clearly established. (auth)

14362

THE HALF-LIFE OF AMERICIUM-243. A. B. Beadle, D. F. Dance, K. M. Glover, and J. Milstead (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 12, 359-61(1960) Feb.

The half life of Am^{243} was determined by isotopic dilution with Am^{241} and mass spectrometric and alpha pulse analysis of mixtures in the range $(Am^{243}/Am^{241}) = 2.5$ to 5.5. The mean half-life ratio was found to be 16.70 ± 0.10, corresponding to a half-life of 7650 ± 50 years for Am^{241}. (D.L.C.)

14363

STUDY OF THE K AND L AUGER ELECTRONS OF Ba^{137}. P. Marguin and M. A. Moussa (Institut de Physique Nucléaire, Lyon). J. phys. radium 21, 149-56(1960) Mar. (In French)

Using a double focusing magnetic spectrometer with iron-free coils, the energies and relative intensities of the groups of Auger K lines resulting from the decay of Cs^{137} have been determined. Auger L electrons have been studied also. (auth)

14364

INTERACTIONS BETWEEN MATTER AND RADIATION IN FUNCTIONAL THEORY. M. Pham Xuân Yêm (Institut Henri-Poincaré, Paris). J. phys. radium 21, 185-8(1960) Mar. (In French)

The interactions between an electron and many photons are expressed by the terms of coupling in the equations of those two types of particles. The action of the electron is represented in the electromagnetic equations of the photons in terms of electric and magnetic moments and in charge and current densities. Conversely, the potentials created by the photons will react upon the movement of the electron. (auth)

14365

DIFFERENTIAL CROSS SECTIONS FOR THE REACTION $C^{12}(d,p)C^{13}$ IN THE ENERGY RANGE OF DEUTERONS FOR 15- TO 20-Mev. Susumu Morita, Nawoyuki Kawai, Naoyuki Takano, Yorio Gotô, and Reiko Hanada (Kyushu Univ., Fukuoka); Yutaka Nakajima (Tokyo Univ.); and Shigeo Takemoto and Yūki Yaegashi (Tôhoku Univ., Sendai). J. Phys. Soc. Japan 15, 550-6(1960) Apr. (In English)

The angular distributions of protons from the reaction $C^{12}(d, p)C^{13}$ were measured at the deuteron energies of 14.9, 16.6, 18.1, and 19.6 Mev for the proton groups leading to the lowest four levels of C^{13}. The proton groups to the second and third excited states were not resolved. The measurements covered the angular range from 15 to 165 degrees at intervals of 7.5 degrees. The results were compared with the stripping theory and qualitative agreement in the forward directions was obtained, but not in the backward. The best fits for the angular distributions of the ground state group were obtained with the nuclear radius of $6.3 \pm 0.1 \times 10^{-13}$ cm with Bhatia's formula. The angular distributions changed regularly with the deuteron energy. The excitation function was found to decrease monotonically with the increase of deuteron energy but that in the backward directions showed a slower decrease than that for the forward directions. (auth)

14366

ELASTIC AND INELASTIC SCATTERING OF 11.2 Mev DEUTERONS. Minoru Takeda (Osaka Univ.). J. Phys. Soc. Japan 15, 557-66(1960) Apr. (In English)

The differential cross section for deuteron-nucleus elastic scattering was measured for N, O, Ne, Mg, Al, S, Ar, Ca, Cr, Fe, Ni, Cu, Kr, Ag, Xe, and Au at the deuteron energy of 11.2 Mev. Measurements were done at 5° intervals from 15° to 165° with relative uncertainty of 3 to 5%. The measured cross sections show a pronounced diffraction pattern in light and medium weight nuclei, but the cross sections for heavier elements show a smooth decrease and are smaller than the Rutherford cross sections. The cross sections of deuterons leading to the first excited state of Ne^{20} and Mg^{24} by inelastic scattering were obtained. However, inelastically scattered deuterons could not be detected in other elements. The angular distributions for Ne^{20} and Mg^{24} are explained by the direct nuclear process. (auth)

14367

THE HYPERFINE STRUCTURE SPLITTING OF THE $^{2}S_{1/2}$ GROUND STATE AND THE NUCLEAR MAGNETIC DIPOLE MOMENT OF Au^{197}. G. Fricke, S. Penselin, and E. Recknagel (Universität, Heidelberg, Ger.). Naturwissenschaften 47, 129(1960). (In German)

Between the hyperfine structure levels F = 2 and F = 1, high-frequency transitions satisfying the selection rule $\Delta F = \pm 1$, $\Delta m_F = \pm 1$ were induced. The hyperfine structure splitting was determined to be $\Delta\nu(^{2}S_{1/2}) = 6099.309 \pm 0.010$ MHz. The nuclear magnetic dipole moment was determined directly to be $\mu_I(Au^{197}) = +0.1431 \pm 0.0014\ \mu_K$. (J.S.R.)

14368

ISOTOPIC DISPLACEMENT BETWEEN THE STABLE Sr ISOTOPES AND Sr^{90} AND THE DISCONTINUITY IN THE NUCLEAR VOLUME EFFECT AT NEUTRON NUMBER 50. Klaus Heilig and Andreas Steudel (Universität, Heidelberg, Ger.). Naturwissenschaften 47, 129-30(1960). (In German)

The measurement of the relative isotopic position of an element, necessary for the detection of an instability in the nuclear volume effect, was carried out on strontium isotopes. The isotopic displacements of the isotopes Sr^{84}, Sr^{86}, Sr^{88}, and Sr^{90} were determined with a photoelectric recording Fabry-Perot spectrometer. The results are tabulated and show that for the 84, 86, and 88 isotopes a displacement in the direction of volume dependent effects is observed. The isotopic displacement between the 88 and 90 isotopes has the sign of the nuclear volume effect. To evaluate the nuclear volume effects from the isotopic displacements, the volume dependent effect was determined. The values are tabulated. A comparison is also given of the discontinuity of the nuclear volume effect at neutron numbers of 50, 82, and 126 with respect to the ratio $\beta C_{ext}/C_{th}$ (the ratio of the observed nuclear volume effect to the nuclear volume effect calculated for homogeneous charged spherical nuclei). (J.S.R.)

14369

U-235 FISSION PRODUCT DECAY ENERGY. I. J. Macbean (Atomic Energy Establishment, Winfrith, Eng.). Nuclear Power 5, No. 49, 115-17(1960) May.

A graphical method for calculating total gamma power output and total beta plus gamma power output is outlined. The method, applied to U^{235} fission, gave 7.0 ± 1 Mev/fission for gamma radiation, 5.7 ± 1.0 Mev/fission, for beta radiation, and 8.5 ± 1.4 Mev/fission for neutrino radiation; so that the average total absorbable energy (sum of gamma and beta) is 12.7 ± 1.3 Mev/fission. (D.L.C.)

14370

X-RAY ATTENUATION COEFFICIENTS FROM 13 TO 80 MEV FOR HYDROGEN, CARBON, WATER, AND ALUMINUM. J. M. Wyckoff and H. W. Koch (National Bureau of Standards, Washington, D. C.). Phys. Rev. 117, 1261-74 (1960) Mar. 1.

The x-ray-attenuation coefficients for H, C, H_2O, and Al were measured in the energy range from 13 to 80 Mev by placing varying lengths of attenuators in a 90-Mev bremsstrahlung beam. In the case of H, a different method employing cyclohexane and graphite was used. The theoretical attenuation coefficients were calculated using selected Compton and triplet cross sections in addition to the small quasi-deuteron cross sections. A pair cross-section increase of 2.25% was required for C, H_2O, and Al to bring the calculated coefficients into agreement with the measured coefficients in the 60-Mev region. The difference between the calculated and the measured cross sections in the 13- to 50-Mev region is ascribed to giant resonance nuclear absorption. A larger high-energy tail to this absorption than that predicted by (γ,p) and (γ,n) experiments is indicated. (auth)

14371

ELASTIC SCATTERING OF HEAVY NUCLEI. J. S. McIntosh, S. C. Park, and J. E. Turner (Yale Univ., New Haven). Phys. Rev. 117, 1284-6(1960) Mar. 1.

A program is presented for determining the differential cross section for the elastic scattering of heavy nuclei. It utilizes the unitary property of the S matrix and a less drastic L dependence of the absorption than the sharp cut-off model of Blair. Experimental data from $N^{14}-N^{14}$ scattering can be fitted quite well. (auth)

14372

MAGNETIC MOMENT OF Fe^{57}. G. W. Ludwig and H. H. Woodbury (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 117, 1286-7(1960) Mar. 1.

An electron-nuclear double resonance study was made on the spectrum of neutral iron atoms in silicon. These measurements give a value of +0.0903 ± 0.0007 nm for the magnetic moment of Fe^{57}. (auth)

14373

MAGNETIC MOMENT OF Au^{197}. H. H. Woodbury and G. W. Ludwig (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 117, 1287-8(1960) Mar. 1.

Chromium-gold and manganese-gold impurity pairs in silicon were observed by electron spin resonance techniques. Electron-nuclear double resonance studies of the gold hyperfine structure give a value of 0.1439 ± 0.0004 nm for the magnetic moment of Au^{197}. (auth)

14374

EXCITED STATES IN N^{14} FROM $C^{12}(d,d)C^{12}$, $C^{12}(d,p_0)C^{13}$, AND $C^{12}(d,p_1)C^{13}$. E. Kashy, R. R. Perry, and J. R. Risser (Rice Inst., Houston, Tex.). Phys. Rev. 117, 1289-96(1960) Mar. 1.

Excited states in the N^{14} nucleus were observed by measuring the differential scattering and reaction cross sections of $C^{12}(d,d)C^{12}$, $C^{12}(d,p_0)C^{13}$, and $C^{12}(d,p_1)C^{13*}$ for deuteron bombarding energies from 0.5 to 2.0 Mev. Resonances were investigated at 0.92, 1.19, 1.31, 1.446, and 1.79 Mev, corresponding to excited states at 11.05, 11.29, 11.39, 11.503, and 11.80 Mev in N^{14}. Scattering matrix analysis of the elastically scattered deuterons and of angular distributions of the reaction protons to the ground state of C^{13} gave assignments of 1^+, 2^-, 1^+, 3^+, and 1^+ for these states. The analysis of the $C^{12}(d,p_0)C^{13}$ angular distributions at 0.92, 1.19, and 1.31 Mev indicated a reaction mechanism in which the relative proton-neutron spin orientation of the deuteron is preserved. (auth)

14375

BETA SPECTRA OF THE MIRROR NUCLEI. Roger Wallace and Jasper A. Welch, Jr. (Univ. of California, Berkeley). Phys. Rev. 117, 1297-1305(1960) Mar. 1.

The positron spectra and half lives of all the mirror nuclei ($2Z = A \pm 1$) with $19 \leq A \leq 39$ were measured with a 180°-deflection uniform magnetic field spectrometer. The ground-state transition energies were used to compute Coulomb-energy differences between mirror pairs. Deviations of these Coulomb-energy differences from a smooth variation with A are explained by a nuclear shell model using the potential well of an isotropic harmonic oscillator. The data support a symmetry for the proton wave functions characteristic of the state of lowest seniority, with magic-number effects at A = 14 and 16 as well as 8 and 20. Comparison of the ft values obtained with experimental nuclear magnetic moments gives the following values for the partial coupling constants for the Fermi and Gamow-Teller β interactions: $g_F^2 = 1.5 \pm 0.1 \times 10^{-4}\ sec^{-1}$, $g_{GT}^2 = 2.2 \pm 0.1 \times 10^{-4}\ sec^{-1}$. Nuclear radii from μ-mesic atoms, when properly interpreted, are shown to be in agreement with radii deduced from Coulomb energy differences. (auth)

14376

FISSION CROSS SECTION OF PLUTONIUM-242. Daniel K. Butler (Argonne National Lab., Lemont, Ill.). Phys. Rev. 117, 1305-6(1960) Mar. 1.

The cross section for neutron-induced fission of Pu^{242} was measured between 0.1 and 1.7 Mev by determining the ratio of the Pu^{242} fission cross section to that of U^{235} using a back to back gas scintillation counter. The cross section is plotted versus neutron energy. (auth)

14377

HYDROGEN–HELIUM ISOTOPE ELASTIC SCATTERING PROCESSES AT INTERMEDIATE ENERGIES. J. E. Brolley, Jr., T. M. Putnam, L. Rosen, and L. Stewart (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 117, 1307-16 (1960) Mar. 1.

Differential cross sections for the elastic scattering of various H and He isotopes were measured over an energy range of 5 to 14 Mev. p-d scattering is compared with that of n-d at similar energies. The scattering of 10-Mev polarized protons from deuterons provides support for central force approximations in calculations. Angular distributions of p-t and p-He^3 scattering at 6.5 and 8.34 Mev are similar to those of p-d and p-He^4 scattering and gives agreement with resonating-group calculations. Treatment of d-d scattering at 6.0, 8.2, 12.1, and 13.8 Mev indicates that it is predominantly hard-sphere scattering with no strong level splitting. d-t scattering was found to be indistinguishable at 5.6 to 14.4 Mev from d-He^3 scattering. (auth)

14378

EXTENSION OF THE BLATT-BIEDENHARN FORMALISM FOR RESONANCE REACTIONS. Harry Lustig (Nuclear Development Corp. of America, White Plains, N. Y. and City Coll., New York). Phys. Rev. 117, 1317-24(1960) Mar. 1.

The Blatt-Biedenharn formalism for the calculation of cross sections in resonance reactions is extended to provide for (1) empirical spin-orbit effects in the potential scattering, (2) the interference of resonances of unequal spin and/or parity, and (3) the energy spread of the incident particle. Explicit formulas are given for the total cross section and for the Legendre polynominal expansion coefficients in the differential cross section, for single channel elastic scattering, in the presence of all three effects. For a general multichannel reaction, explicit reaction and elastic scattering formulas, both differential and total, are derived only for the second situation. (auth)

14379

F^{19}, Na^{23}, AND Al^{27} (α,n) REACTIONS. R. M. Williamson, T. Katman, and B. S. Burton (Duke Univ., Durham, N. C.). Phys. Rev. 117, 1325-9(1960) Mar. 1.

The F^{19}, Na^{23}, and Al^{27} (α,n) yield curves are given from threshold to about 4 Mev. Convenient resonances for alpha particle energy calibration in these reactions and in the C^{13}(α,n) reaction are pointed out. Slow-fast neutron data and γ ray data for F^{19}(α,n) agree with the proposed 593- and 666-kev Na^{22} levels. The Al^{26m}(228 kev) β activity was observed in the Na^{23}(α,n) reaction. The neutron resonance absorption technique gave Q = −1959 ± 10 kev for F^{19}(α,n). The 32° ± 3° angle cut-off of Na^{23}(α,n) neutrons at T_α = 3492 ± 3 kev gave a Q value of −2969 ± 4 kev. The threshold for P^{30} β activity gave Q ≥ −2662 ± 5 kev for Al^{27}(α,n). (auth)

14380

GAMMA RAYS FROM NEUTRON INELASTIC SCATTERING IN B^{10}, F^{19}, AND Fe^{56}. Robert B. Day and Martin Walt (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 117, 1330-3 (1960) Mar. 1.

The cross section for excitation of the 0.72-Mev gamma ray in the B^{10}(n,n′γ)B^{10} reaction was measured from threshold to 5.2 Mev. Resonances were observed at 1.93, 3.31, 4.1, and 4.73 Mev, with evidence of a broad resonance at 2.6 Mev. The angular distributions of the 0.110-Mev and 0.197-Mev gamma rays in the F^{19}(n,n′γ)F^{19} reaction and the 0.847-Mev gamma ray in the Fe^{56}(n,n′γ)Fe^{56} reaction were also measured at 2.56 Mev. The first of these was isotropic, the last two showed anisotropies but were symmetrical about 90°. The angular distribution of the Fe^{56} gamma ray agrees well in both shape and absolute magnitude with calculations based on the statistical model. (auth)

14381

TOTAL REACTION CROSS SECTIONS OF SEVERAL NUCLEI FOR 61-MEV PROTONS. Verena Meyer, R. M. Eisberg, and R. F. Carlson (Univ. of Minnesota, Minneapolis). Phys. Rev. 117, 1334-6(1960) Mar. 1.

The total reaction cross sections of C, Al, Fe, and Sn for 61-Mev protons were measured by a beam attenuation technique. The results are compared with total reaction cross sections for neutrons and with optical model calculation. (auth)

14382

(p,α) REACTIONS INDUCED BY PROTONS IN THE ENERGY RANGE OF 9.5–23 MEV. Clyde B. Fulmer and Charles D. Goodman (Oak Ridge National Lab., Tenn.). Phys. Rev. 117, 1339-44(1960) Mar. 1.

The outgoing alpha particles from nuclear reactions induced by protons between 9.5 and 23 Mev in numerous elements throughout the periodic table were studied. Alpha-energy distributions and absolute differential (p,α) cross sections were measured at 90°. From the integrals of the alpha-energy distributions, excitation functions for (p,α) reactions were determined. Excitation functions for (p,α) reactions in targets for which compound nuclei are integral numbers of alpha particles are qualitatively different from those of other targets. Alpha-energy distributions for targets with $Z \lesssim 50$ (except for F and Al) are peaked at about the same energy for incident proton energies of 9.5 to 23 Mev; this may be interpreted as evidence that the Coulomb barrier is lowered for alpha-particle emission from excited compound nuclei. (auth)

14383

ENERGY AND ANGULAR DISTRIBUTIONS OF ALPHA PARTICLES FROM REACTIONS OF HIGH-ENERGY PROTONS WITH Ag AND Br NUCLEI. Elizabeth W. Baker, Charles P. Baker, and Seymour Katcoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 117, 1352-60(1960) Mar. 1.

An investigation was made on the energy and angular distributions of α particles emitted from silver and bromine nuclei during bombardments with 1.0-, 2.0-, and 3.0-Bev protons. The α energies studied were in the interval from 0 to 50 Mev with particular emphasis placed on the low-energy region. An attempt was made to correct the observed spectra for the center-of-mass motion of the emitting nucleus and then to compare these spectra with those calculated from nuclear evaporation theory. Two sets of center-of-mass transformations were made; in one case the beam direction was considered to be that of the moving system and in the second case the direction of the observed recoil was considered to be that of the moving system. Good agreement was obtained with the theoretical spectra throughout the energy region studied. An apparent excess of low-energy α particles in the uncorrected spectra was removed by assuming that the emitting nucleus moves in the observed direction of the recoil at 0.015c at 1.0 Bev and 0.02c at 2.0 Bev, which were consistent with the measured lengths of the observed recoil nuclei. Both the angular distributions of the recoil fragments and of the

α particles were consistent with random emission from this moving system. (auth)

14384

$C^{12}(p,pn)C^{11}$ CROSS SECTION FROM 3 TO 6 Bev. Nahmin Horwitz and Joseph J. Murray (Univ. of California, Berkeley). Phys. Rev. 117, 1361-3(1960) Mar. 1.

The $C^{12}(p,pn)C^{11}$ cross sections were measured at proton energies of 3.0, 4.5, and 6.0 Bev. The measured values are 29.8 ± 1.6, 27.7 ± 1.7, and 29.8 ± 1.6 mb, respectively. (auth)

14385

NUCLEAR SHELL EFFECTS IN μ^- CAPTURE. G. H. Burkhardt (Columbia Univ., New York) and C. A. Caine (Clarendon Lab., Oxford). Phys. Rev. 117, 1375-8(1960) Mar. 1.

The calculation for the variation of spin-dependence of nuclear transitions was carried out for N^{14}, O^{16}, and F^{19}, using shell-model wave functions which included configurational mixing in the unfilled shell. The result is not sufficiently spin sensitive to determine the Fermi and Gamow-Teller couplings separately at this stage, but it is in accord with the universal V-A hypothesis, if a conserved vector current pion-lepton interaction is included. (auth)

14386

HYPERFINE SPLITTING OF THE LITHIUM GROUND STATE. Lester M. Sachs (Argonne National Lab., Lemont, Ill. and Illinois Inst. of Tech., Chicago). Phys. Rev. 117, 1504-6(1960) Mar. 15.

Calculations of the hyperfine splitting of the lithium atom ground state were done by the Hartree-Fock (HF), unrestricted Hartree-Fock (UHF) and projected UHF approximations to the ground-state eigenfunctions. The exchange polarization effect allowed by the UHF method yields a 34.9% increase in the hyperfine splitting compared to the HF method. (auth)

14387

EVALUATION OF THE INTERACTION EFFECT IN n-p CAPTURE. N. Austern and E. Rost (Univ. of Pittsburgh, Penna.). Phys. Rev. 117, 1506-10(1960) Mar. 15.

Recent information about the nuclear force was used to recalculate the thermal n-p capture cross section, and a value of 0.303 ± 0.012 b is obtained. The comparison of this number with the experimental cross section of 0.3315 ± 0.0017 b indicates an "interaction" magnetic dipole moment contribution of 0.028 ± 0.012 b. (auth)

14388

DECAY OF Os^{182} AND Os^{183}. I. GAMMA AND BETA SPECTROSCOPY. John O. Newton (Univ. of California, Berkeley). Phys. Rev. 117, 1510-19(1960) Mar. 15.

Four activities, produced by the bombardment of tungsten with alpha particles having energies up to 48 Mev, were identified. They have half-lives of 9.9 ± 0.3, 13.67 ± 0.1, 21.1 ± 0.3, and >500 hours. From the excitation functions and other measurements these are attributed to the decay of Os^{183m}, Os^{183}, and Os^{185}, respectively. Measurements on the gamma-ray spectra and conversion line spectra are reported. The spectra are complex, and a total of 251 conversion lines was observed. In many cases the decay of individual gamma rays and conversion lines was studied. (auth)

14389

DECAY OF Os^{182} AND Os^{183}. II. COINCIDENCES, CONVERSION COEFFICIENTS, AND DECAY SCHEMES. John O. Newton (Univ. of California, Berkeley). Phys. Rev. 117, 1520-8(1960) Mar. 15.

The 382-kev transition in Re^{183} was shown to have a conversion coefficient of 1.09 ± 0.14 × 10^{-2} which established the transition as E1. The half-life of the state from which this arises was found to be 7.7 ± 0.5 × 10^{-9} sec from delayed coincidence measurements, indicating a hindrance factor of 3 × 10^6 relative to the single particle value. Other transition multipolarities were assigned from their conversion coefficients, L subshell and K/L ratios as obtained from the preceding paper. Amongst these the 170.72-kev isomeric transition in Os^{183} was identified and shown to be M4 with a hindrance factor of 12. Decay schemes for Os^{183} and Os^{183m} are established and good agreement is obtained between the proposed spins and parities and those suggested by the scheme of energy levels in a spheroidal potential as calculated by Nilsson. (auth)

14390

AUGER TRANSITIONS IN Re^{183} AND THE M3 ISOMER IN Os^{189}. John O. Newton (Univ. of California, Berkeley). Phys. Rev. 117, 1529-32(1960) Mar. 15.

The rhenium KLL, KLM, KLN, and KLO auger lines were observed in experiments on the decay of Os^{182} and Os^{183}. The measured energies are compared with those given by semiempirical theories due to Bergström and Hill and to Asaad and Burhop; satisfactory agreement is found. A comparison of the measured intensities with those given by the nonrelativistic theory of Asaad and Burhop shows less satisfactory agreement. Conversion lines attributed to a previously reported M3 isomer in Os^{189} were observed and the transition energy found to be 30.81 ± 0.03 kev. L- and M-subshell ratios are reported. The transition appears to be hindered by a factor of 5 × 10^4 relative to the single-particle estimate. (auth)

14391

REACTIONS OF PROTONS WITH Ni^{58} AND Ni^{60}. Sheldon Kaufman (Princeton Univ., N. J.). Phys. Rev. 117, 1532-8 (1960) Mar. 15.

Excitation functions were measured for the $Ni^{58}(p,2p)$, $Ni^{58}(p,pn)$, and $Ni^{58}(p,\alpha)$ reactions up to 19 Mev, and for the $Ni^{60}(p,\alpha)$ reaction up to 13 Mev. The ratio of the (p,2p) cross section to the (p,pn) cross section is 3.5 at 19 Mev, and increases with decreasing energy. It is proposed that this excess of proton emission can be accounted for by nuclear evaporation theory, and a computer calculation of the excitation functions using this theory is described. The calculation reproduces the (p,2p) and (p,pn) curves quite well, and gives evidence that the compound nucleus mechanism probably applies to these reactions. The calculated (p,α) curve does not agree with the experimental results as well. (auth)

14392

ANALYSIS OF ELASTIC CROSS SECTIONS AND POLARIZATION OF 10-Mev PROTONS. J. S. Nodvik (Univ. of Southern California, Los Angeles) and David S. Saxon (Univ. of California, Los Angeles). Phys. Rev. 117, 1539-44(1960) Mar. 15.

The differential elastic cross section and polarization of 10-Mev protons scattered by argon and copper were analyzed using a diffuse surface optical model potential with a spin-orbit term. The model parameters were varied systematically, the best fits with the experimental data being determined by a method of least squares. It was found that almost equally good fits could be obtained over a range of values of the radius constant, R_0, between 1.20 and 1.30. Only the value of the real part of the central potential was markedly different for the best fits obtained for various R_0 in this range. The experimental polarization data is not precise enough to determine the spin-orbit potentials to within better than 1 or 2 Mev. (auth)

14393

ELASTIC SCATTERING OF NITROGEN BY CARBON. M. L. Halbert, C. E. Hunting, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 117, 1545-51(1960) Mar. 15.

The differential cross section for the elastic scattering of nitrogen from thin carbon foils was measured from 40 to 140° in the center-of-mass system at three energies: 27.3, 23.5, and 21.5 Mev, mean energy in the 1-Mev thick targets. The angular resolution was about 1 deg. Scattered nitrogen and recoil carbon atoms were counted in coincidence. Positions of the two counters, as prescribed by the kinematics of elastic scattering, served to discriminate against inelastic events and transfer reactions. The differential cross sections at all three energies exhibit marked structure especially beyond 90 deg. An optical model scattering calculation using a Saxon potential with $V = 45$ Mev, $W = 6$ Mev, and $a = 0.65$ fermi was performed and exhibits fair agreement with the data. The results of the experiment are also compared with the predictions of a sharp cutoff model for elastic scattering and show no agreement with the theory. Analyzing the data in terms of a diffraction model the positions of the well-defined minima yield an interaction distance R such that $r_0 = 1.18 \pm 0.02$ in the relation $R = r_0(A_1{}^{1/3} + A_2{}^{1/3})$. (auth)

14394

SINGLE PARTICLE MOTION IN A DEFORMED, NONLOCAL POTENTIAL WELL. R. H. Lemmer (Florida State Univ., Tallahassee). Phys. Rev. 117, 1551-61(1960) Mar. 15.

The effects of the nonlocal character of the average nucleon-nucleus interaction on single particle motion in a strongly deformed field are examined by using a simple phenomenological description of the nonlocal interaction and introducing an effective mass approximation for a finite nuclear system. The eigenvalues and eigenfunctions of the anisotropic harmonic oscillator potential are used as a starting point for a perturbative treatment of the nonlocal interaction, and the resulting energy level scheme is given as a function of the nuclear deformation. A conventional spin-orbit interaction is also included. The main effects of the nonlocal interaction appear as an increase in the level spacing of the unperturbed oscillator states combined with an additional interaction energy which can be interpreted as an effective angular momentum dependence of the average potential field. Calculations of nuclear equilibrium deformations based on the computed level schemes are presented. It is found that the preponderance of prolate nuclear shapes found empirically can be accounted for quite well by the nonlocal model and results essentially from the favoring of high angular momentum substates that are introduced by the nonlocal interaction. (auth)

14395

PROPERTIES OF THE EXCITED STATES OF Na^{22} FROM THE $Ne^{21}(p,\gamma)$ REACTION. R. W. Krone and J. J. Singh (Univ. of Kansas, Lawrence). Phys. Rev. 117, 1562-4 (1960) Mar. 15.

Proton capture resonances in Ne^{21} were observed at 776, 865, 1010, 1120, 1215, 1296, and 1354 kev for proton bombarding energies ranging between 600 and 1500 kev. Pulse-height spectra of the resultant gamma radiation are presented for the two lowest resonances. At the 776-kev resonance the transitions are predominantly to the ground state, whereas the 865-kev resonance seems to decay mainly to the 2.25-Mev state. Arguments are presented showing that this is consistent with identifying this level as the second $T = 1$, $J = 2^+$ state in Na^{22}. (auth)

14396

BETA-GAMMA DIRECTIONAL CORRELATION IN THE DECAY OF Co^{60} AND Na^{22}. H. Daniel and G. W. Eakins (Iowa State Univ. of Science and Tech., Ames). Phys. Rev. 117, 1565-7(1960) Mar. 15.

The differential and integral beta-gamma directional correlations in the decay of Co^{60} and Na^{22} were measured with scintillation counters. Both beta transitions are allowed but have high ft values; therefore, small anisotropies are not excluded. In the case of Co^{60} the anisotropy was found to be zero for all beta energies above 0.06 Mev; the integral anisotropy was measured to be $A = -0.0003 \pm 0.0017$ (standard deviation). In the case of Na^{22} the results seem to indicate an energy dependence of the anisotropy; the value is uncertain because of coincidences between positrons and annihilation quanta. (auth)

14397

(n,He^3) REACTIONS OF MEDIUM WEIGHT NUCLEI INDUCED BY 14.8-MEV NEUTRONS. I. Kumabe, A. D. Poularikas, I. L. Preiss, D. G. Gardner, and R. W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev. 117, 1568-9 (1960) Mar. 15.

Activation of the following pure monoisotopic elements with 14.8-Mev neutrons gives rise to (n,He^3) reactions, the radioactive products having the following measured half lives and formation cross sections: $Mn^{55}(n\ He^3)V^{53}$, 2 ± 0.3 min, 2 to 6 mb; $Co^{59}(n,He^3)Mn^{57}$, 1.75 ± 0.2 min, 1 to 3 mb; $As^{75}(n,He^3)Ga^{73}$, 5.1 ± 0.3 hours, 3 to 7 mb; and $Rh^{103}(n,He^3)Tc^{101}$, 15 ± 3 min, 1.5 to 3.5 mb. A qualitative discussion is presented concerning the possible mechanisms for these reactions. (auth)

14398

SEARCH FOR DOUBLE-QUANTUM EMISSION IN THE DECAY OF Xe^{131m}. Torsten Alväger and Hans Ryde (Nobel Inst. of Physics, Stockholm). Phys. Rev. Letters 4, 363-4(1960) Apr. 1.

Coincidence measurements were made between the γ and x rays in the decay of Xe^{131m}. In the plot of coincidence measurements data, an outstanding peak is observed for which two-quantum emission is given as the most probable possibility. Assuming transitions of E2M2 type, a ratio of $\sim 2 \times 10^{-3}$ is obtained between double- and single-quantum emission after correction for internal K conversion. (C.J.G.)

14399

RESONANT ELASTIC SCATTERING OF C^{12} BY CARBON. D. A. Bromley, J. A. Kuehner, and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. Letters 4, 365-7(1960) Apr. 1.

The elastic scattering of C^{12} by carbon and O^{16} was studied at 6 to 29 Mev using high-resolution Au—Si surface barrier detectors and carbon ion beams from a tandem accelerator. Excitation curves were measured for angles of 45, 28.8, and 19.5°. At energies above the Coulomb barrier, the curves at 45 and 28.8° show pronounced resonance structure corresponding to $Mg^{24} \geq 24$ Mev. Only very weak residual structure is observed at 19.5°. (C.J.G.)

14400

QUESTION OF NUCLEON CLUSTERS IN THE NUCLEAR SURFACE. I. E. McCarthy and D. J. Prowse (Univ. of California, Los Angeles). Phys. Rev. Letters 4, 367-9 (1960) Apr.

Wilkinson suggested that evidence for the existence of nucleon clusters in the region of the nucleus where the density is less than 20% of its central value is provided by the absorption of K^- mesons by nuclei in photographic emulsions. Wilkinson determined that the two-nucleon reaction occurs in the periphery and assumes that the mechanism for the absorption of K^- meson is a reaction with the first nucleon or cluster that it encounters. It is known from the interaction of K^- mesons in a hydrogen bubble chamber that the cross section for elastic scattering is roughly equal to that for the catastrophic reaction producing a Σ hyperon. A mechanism which reconciles the above facts is as follows: the K^- meson, elastically scattered by the first nucleon it encounters, drops into a part of the nuclear surface where the density is comparable with that of saturated nuclear matter. Most of the one-nucleon events would be expected to take place in the periphery, but all of the two-nucleon events to take place in a region where the density of nuclear matter is an appreciable fraction of its maximum value. (C.J.G.)

14401

A SHORT-LIVED HEAVY ISOTOPE OF LUTETIUM. A. H. W. Aten, Jr. and A. G. Funke-Klopper (Instituut voor Kerphysisch Onderzoek, Amsterdam). Physica 26, 79-80 (1960) Jan.

Hafnium irradiated with fast neutrons yields a rare earth fraction with a beta activity period of $4\frac{1}{2} \pm 1$ minutes and photopeaks of about 51, 88, 215, 322, and 413 kev. This activity is postulated to be a Lu isotope of even mass number, probably either Lu^{180} or an isomer of the 22-minute activity of Lu^{178}. (D.L.C.)

14402

GAMMA RAYS FROM Au^{196}. R. K. Gupta (Instituut voor kernphysisch Onderzoek, Amsterdam). Physica 26, 69-74(1960) Jan. (In English)

The gamma-ray spectrum from the decay of Au^{196} was investigated with a scintillation spectrometer. New gamma rays of 1080 ± 20 and 725 ± 20 kev were detected. Summing studies indicate a new level at 1080 ± 20 kev in Pt^{196}. Some indication is found for the existence of a weak ground state transition from the 685 kev level in Pt^{196}. (auth)

14403

OPTICAL HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF PROMETHIUM 147. P. F. A. Klinkenberg (Zeeman-Laboratorium der Universiteit, Amsterdam) and F. S. Tomkins (Argonne National Lab., Lemont, Ill.). Physica 26, 103-14(1960) Feb. (In English)

The hyperfine structure of a number of Pm^{147}I- and II-lines was measured. From the best resolved patterns it is concluded that the ground state spin of the Pm^{147} nuclide is $^7/_2$. On plausible assumptions concerning the electronic level scheme of Pm II the value of the nuclear magnetic moment turns out to be 2.7 nuclear magneton, with an estimated uncertainty of ±10%. The nuclear electric quadrupole moment is small. The results are discussed in connection with the nuclear shell model and radioactive decay data. (auth)

14404

THE INTERPRETATION OF THE LOW ENERGY STATES OF Po^{214} (RaC′). C. Mayer-Böricke and G. Lührs (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 15a, 103-7(1960) Feb. (In German)

The K/L and K/M conversion ratios of the 769 and 609 kev γ radiations of Po^{214} were measured with a double-focusing β spectrometer. For the K/L ratios the values 3.95 ± 0.2 and 3.43 ± 0.1 were obtained. According to the tables of Rose, both transitions are very pure E2 radiations. This coincides with the conclusions of the theory of collective quadrupole vibrations. This theory, in the modified form of Wilets and Jean, was used for the interpretation of the low-excited levels (609, 1378, and 1416 kev) of Po^{214}. Following this model of γ unstable quadrupole vibrations, one obtains for the nuclear equilibrium deformation the value $\beta_0 \approx 6.7 \times 10^{-2}$. (auth)

14405

$\beta-\gamma$ POLARIZATION CORRELATION IN Co^{60} β DECAY. V. M. Lobashev, V. A. Nazarenko, and L. I. Rusion (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1810-11(1959) Dec.

Correlations of transversely polarized electrons and circularly polarized γ quanta in Co^{60} β decay are discussed. Electrolytically prepared Co^{60} (100 μc) was used for determining the correlation magnitude as a function of coincidence rate variation. Measurements with a 0.4 mg/cm^2 thick bismuth electron scatterer show $\Delta = (0.50 \pm 0.18)\%$. The efficiency of the γ polarimeter was determined by measuring $\beta-\gamma$ correlation (γ circularly polarized) in Co^{60} and Sc^{46} decay. The β polarimeter was calculated geometrically considering multiple scattering in bismuth foil. The results show $A = 0.32 \pm 0.12$, in good agreement with theoretical and experimental data. (R.V.J.)

14406

ON THE GIANT RESONANCE FINE STRUCTURE. N. A. Burgov, G. V. Danilyan, B. S. Dolbilkin, L. E. Lazareva, and F. A. Nikolaev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1811-14(1959) Dec. (In Russian)

The method of total absorption was used for determining the giant resonance structure. Data for carbon measured with an x-ray beam of $E_{max} = 28.8$ Mev and collimated with a 26 cm thick lead collimator are plotted. The method proved efficient and indicates with a high order of precision the positions of separate cross section peaks. (R.V.J.)

14407

CORRELATIONS OF EFFECTIVE TEMPERATURES FOR NEUTRON SPECTRA EMITTED IN U^{235} AND Pu^{239} FISSION BY FAST AND SLOW NEUTRONS. G. M. Smirenkin. Zhur. Eksptl'. i Teoret. Fiz. 37, 1822-4(1959) Dec. (In Russian)

The method of threshold indicators was used for determining the magnitude of dT_{ef}/dE_n. The fission neutrons were produced by fast and slow neutron bombardment. $\mathrm{Be}^9(d,n)\mathrm{B}^{10}$ served as a fast neutron source; thermal neutron bombardment was accomplished in a paraffin block. Hollow metallic U^{235} (90% enriched) and Pu^{239} specimens with 50 mm outside diameters and 10 mm thick contained the threshold activator $\mathrm{Ag}^{107}(n,2n)\mathrm{Ag}^{106m}$. Measurements were made of the neutron flux above the threshold (9.5 Mev) of the $\mathrm{Ag}^{107}(n,2n)\mathrm{Ag}^{106m}$ reaction and the number of fission in the sphere (N_γ). The final data showed that for U^{235} $dT_{ef}/dE_n = 0.008 \pm 0.004$ and for Pu^{239} $dT_{ef}/dE_n = 0.01 + 0.004$. Inaccurate assumptions of fast and slow neutron fission distributions explain part of the error of the measurement. (R.V.J.)

14408

ON THE DIRECT NUCLEAR EFFECT THEORY. Yu. V. Orlov (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1834-6(1959) Dec. (In Russian)

An expression for the direct photonuclear effect cross section, considering the spin-orbit bond, was derived within the framework of a dipole approximation in the shell model with jj coupling. The emitting nucleon interaction with the nucleus is described by the optical model complex potential. Calculations were developed in nonrelativistic nucleon approximation, limited to nuclei with saturated subshells (with given quantum numbers n, j, and l) or with one nucleon (hole) in a supersaturated shell. (R.V.J.)

14409

CIRCULAR POLARIZATION OF INTERNAL BREMSSTRAHLUNG ACCOMPANYING K-CAPTURE IN Fe^{55}. V. P. Parfenova (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 56-9(1960) Jan. (In Russian)

The circular polarization of the internal bremsstrahlung accompanying K-capture in Fe^{55} was measured by scattering in magnetized iron. The technique of the measurements was based on the azimuthal dependence of the Compton scattering cross section of gamma quanta on polarized electrons. Within the limits of error, 100% polarization of the bremsstrahlung quanta was obtained independent of the radiation energy. (auth)

14410

EXPERIMENTS ON PRODUCTION OF 102-ND ELEMENT. G. N. Flerov, S. M. Polikanov, A. S. Karamyan, A. S. Pasyuk, D. M. Parfanovich, N. I. Tarantin, V. A. Karnaukhov, V. A. Druin, V. V. Volkov, A. M. Semchinova, Yu. C. Oganesyan, V. I. Khalizev, G. I. Khlebnikov, B. F. Myasoedov, and K. A. Gavrilov. Zhur. Eksptl'. i Teoret. Fiz. 38, 82-94(1960) Jan. (In Russian)

Results of new experiments on production of element 102 and investigation of its nuclear properties are described. Pu^{241} and Pu^{239} targets were irradiated by O^{16} accelerated ions; nuclear photoemulsion was used to record decay. α-decay of the obtained isotope (most probably 102^{253}) was observed with a half-life between 2 and 40 sec and α-particle energy of 8.9 ± 0.4 Mev. Careful analysis of possible background sources indicated that the background level is much lower than the effect observed. (auth)

14411

(γ,p)-REACTION ON Au^{197}. E. D. Makhnovskii (Leningrad Inst. of Physics and Tech.). Zhur. Ekspt1'. i Teoret. Fiz. 38, 95-9(1960) Jan. (In Russian)

Energy and angular distributions of protons for gold exposed to bremsstrahlung with $E_{\gamma max} = 22.5$ Mev were obtained. The results are compared with calculations on the basis of the statistical theory and direct photoelectric theories. (auth)

14412

EXCITATION OF VIBRATIONAL LEVELS AND COULOMB EXCITATION IN α-DECAY. V. M. Strutinskii. Zhur. Eksptl'. i Teoret. Fiz. 38, 122-33(1960) Jan. (In Russian)

The relative probability of excitation of vibrational levels in the α-decay of even-even nuclei is calculated. An expression for the intensity of excitation of the daughter nucleus by α-particles of the main (allowed) group is derived in the quasi-classical perturbation theory approximation. The results obtained are applied to an analysis of the experimental data on the fine structure of α-decay. (auth)

14413

PROBABILITIES OF ELECTROMAGNETIC TRANSITIONS, AND STATIC MOMENTS OF ODD-ODD ATOMIC NUCLEI. D. A. Varshalovich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 38, 172-9(1960) Jan. (In Russian)

Formulas are given relating the probabilities of gamma transitions with the static moments of odd-odd and neighboring odd spherical nuclei, assuming multiplet level structure. A rule of relative intensities was established for transitions to multiplet levels, analogous to that for transitions to rotation band levels in deformed nuclei. This rule facilitates determination of the spins and state configurations of odd-odd nuclei. Examples are discussed. The correctness of the assumptions made is confirmed by satisfactory agreement between the experimental and theoretical values of the magnetic dipole moments for a large group of odd-odd nuclei. (auth)

14414

POLARIZATION OF γ-QUANTA BY THE INTERNAL COMPTON EFFECT. F. Yanoukh (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Ekstpl'. i Teoret. Fiz. 38, 180-3(1960) Jan. (In Russian)

Circular polarization of γ-quanta induced by the internal Compton effect is considered. Angular correlation between the direction of an outgoing β-electron and that of the circularly polarized γ-quantum is presented both for magnetic and electric type transitions. (auth)

14415

COLLECTIVE PROPERTIES OF Si^{30}, Si^{31}, AND Ne^{23}, AND REDUCED WIDTHS IN STRIPPING REACTIONS. V. G. Sukharevskii (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 219-21(1960) Jan. (In Russian)

In the framework of the strong coupling unified model an investigation was made of Si^{30}, Si^{31}, and Ne^{23} collective properties by analyzing experimentally obtained reduced neutron widths in (d,p)-stripping reactions. The analysis indicates that Si^{31} is apparently oblate with the Nilsson deformation parameter $\delta < 0$. However, the analysis does not make it possible to ascertain the shape of Ne^{23} deformation although it does confirm that this nucleus is strongly distorted. The result obtained for Si^{30} does not agree with theoretical calculations and this fact makes it doubtful whether a strong coupling scheme can be applied to this nucleus. (auth)

14416

GREEN'S FUNCTION OF ODD NUCLEI. Yu. T. Grin', S. I. Drozdov, and D. F. Zaretskii. Zhur. Eksptl'. i Teoret. Fiz. 38, 222-8(1960) Jan. (In Russian)

The techniques of the many body theory are applied to a study of pair correlation in finite systems with an odd number of particles. The Green's function was found and the perturbation theory developed. (auth)

14417

ON THE APPEARANCE OF THE SECOND ORDER PROCESS IN DEUTERON INELASTIC SCATTERING BY NUCLEI. V. A. Edakova, V. G. Neudachin, and E. A. Romanovskiĭ (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 248-50(1960) Jan. (In Russian)

The results of the general scattering theory derived by W. M. Fairbaern (Proc. Phys. Soc. A 238, 1957) were applied in calculations of differential cross sections $d\sigma/d\Omega$ in inelastic scattering. The cross sections were determined by Born approximation. The reaction $Mg^{24}(d,d')\,Mg^{24*}$ ($\Delta E = 1.37$ Mev, $E_0 = 15$ Mev) was calculated. The summation was carried out assuming that the intermediate nuclei (I_N) are limited by the lower levels of Mg^{25} and Al^{25} with $5/2^+$, $1/2^+$, and $3/2^+$ spins. Transitions $I_i \rightarrow I_N$ are achieved by capturing only s or d nucleons, and $I_N \rightarrow I_f$ by transmitting either s or d free nucleons. The results are plotted together with data for the $d\sigma/d\Omega$ ratio for the process a. (R.V.J.)

14418

COMPETITION BETWEEN THE NEUTRON EVAPORATION AND FISSION PROCESSES IN MULTICHARGED ION INTERACTIONS WITH HEAVY NUCLEI. N. I. Tarantin.

Zhur. Eksptl'. i Teoret. Fiz. 38, 250-2(1960) Jan. (In Russian)

The participation of neutron evaporation and fission processes in compound nucleus deactivation in heavy element irradiation by multicharged ions was evaluated. The mean values of Γ_n/Γ_f, derived from the relation Γ_n/Γ_f $\bar{G}(1-\bar{G}_n)$, for reactions of C^{12} with Th^{232} and U^{238}, C^{13} with Th^{232} and U^{238}, and O^{16} with U^{238} were determined. Intermediate and final nuclei and numbers of neutrons emitted are tabulated. (R.V.J.)

14419

ENERGY DISTRIBUTION OF PRODUCTS FROM REACTIONS EMITTING SEVERAL PARTICLES. V. V. Komarov and A. M. Papova (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 253-5(1960) Jan. (In Russian)

The spectra of products from reactions emitting several particles can be described by Born approximation, considering interactions of particles in finite states. Energy distributions of He^3 from $T + d \rightarrow He^3 + n + n$ at various angles were calculated for 12-Mev deuterons, considering interactions of two neutrons in finite states. In addition to the energy distributions, the data describe the magnitudes of interaction parameters for emitting particles in finite states. (R.V.J.)

4420

HOTOPROTON YIELD FROM C^{12}. E. B. Bazhanov (Len-grad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. iz. 38, 267-9(1960) Jan. (In Russian)

A scintillation telescope was used in investigating photoproton yield from C^{12} as a function of bremsstrahlung energy. Simultaneous yield curves were plotted for energy ranges from 18.6 to 24.2, 24.2 to 29.9, and 29.9 to 38.7 Mev, with mean energies of 21.4, 27.0, and 34.3 Mev, respectively. All measurements were made at $\theta = 57.5°$ to the γ beam with maximum telescope angular resolution ±6.0°. (R.V.J.)

14421

ASYMMETRY OF URANIUM NUCLEI FISSION BY HIGH ENERGY PROTONS. A. I. Obukhov (Radium Inst. Academy of Sciences, USSR Asymmetry in U Proton Fission). Zhur. Eksptl'. i Teoret. Fiz. 38, 271-4(1960) Jan. (In Russian)

The asymmetry of fission fragments from uranium proton fission at 460 and 660 Mev was studied. The asymmetry corresponds to the general asymmetry of masses. The distributions of light and heavy fragments were plotted and correlated to the distribution from U^{235} fission by thermal neutrons. The correlation indicates a considerable increase of asymmetry with proton energy. (R.V.J.)

14422

ON THE COMPOUND NUCLEUS CROSS SECTIONS IN ATOMIC NUCLEUS INTERACTIONS. V. V. Babikov (Joint Inst. for Nuclear Research Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 274-6(1960) Jan. (In Russian)

Calculations were made of compound nucleus formation cross sections using a model in which the collision nuclei have a strongly spherical boundary and are absolutely absorptive to particles entering the nuclear sphere of action. (R.V.J.)

14423

QUASISTABLE STATE WITH LARGE ISOTOPIC SPIN IN LIGHT NUCLEI. Ya. B. Zel'dovich (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 278-80(1960) Jan. (In Russian)

An odd nucleus A with one excess neutron, minimum isotopic spin $T = \frac{1}{2}$ in the ground state, and neutron bond energy Q was analyzed. The excited state A^*, with excitation energy $E > Q$, has a large width Γ_n in the $A^* \rightarrow B + n$ reaction, where B is an even nucleus. It is assumed that the ground state spin of B is $T = 0$ and in B^*, $T = 1$ with excitation energy Δ. Assuming that nucleus A has an excitation state A_3^* with $T = \frac{3}{4}$ and excitation energy E_3, where $Q < E_3 < Q + \Delta$, the A_3^* decay into $B^* + n$ is energetically impossible and decay A_3^* to $B + n$ proceeds with a variation in isotopic spin and has abnromally small width Γ_n. The A_3^* state is quasistable and should appear in neutron scattering on B and in the $A + \gamma = B + n$ photoeffect. Knowing the isotopic mass of B^{12} and B^{13}, it is possible to determine corresponding states for $C_2^{12^*}$ $(T = 1)$ and $C_3^{13^*}$ $(T = \frac{3}{2})$. Then with $Q = 4.95$ and $\Delta = 11.54$, $E_3 = 11.2$ Mev. Consequently, the $C_3^{13^*}$ level is quasistable, as there is not sufficient energy for $C_2^{12^*} + n$ decay. The narrow resonance in n scattering on C^{12} is at $E_n = 11.2-4.95 = 6.25$ Mev, which corresponds to the experimental neutron energy 7.20 Mev. (R.V.J.)

14424

REACTION (d,t) ON MEDIUM AND HEAVY NUCLEI. N. A. Vlasov, S. P. Kalinin, A. A. Ogloblin, and V. I. Chuev. Zhur. Eksptl'. i Teoret. Fiz. 38, 280-2(1960) Jan. (In Russian)

Triton spectra were measured for (d,t) reactions on Au, Bi, Fe, In, and Zr up to 20 Mev. The tritium activity accumulated in foils was used for evaluating triton spectra. For iron and indium targets the measurements were made at 15 to 40° and for gold and zirconium at 8.5 to 23° and 24.5 to 39°. The triton spectra are plotted. (R.V.J.)

14425

GAMMA SPECTRUM OF La^{140} AT 2300 TO 3900 kev. B. S. Dzhelepov, B. A. Emel'yanov, K. P. Kupriyanova, and Yu. N. Padkopaev (Leningrad State Univ). Zhur. Eksptl'. i Teoret. Fiz. 38, 282-4(1960) Jan. (In Russian)

A γ hodoscope was used in making 4 series of measurements on strong La^{140} γ radiation. The first and fourth series were made with $H = 1159$ and 1226 gauss using preparations of La_2O_3 with less than 50 mc La^{140}. The second and third series were made with $H = 1011$ and 1159 gauss using less than 25 mc of Ba^{140} in equilibrium with La^{140}. The measurement shows four γ lines of 2530 ± 30, 2915 ± 30, 3110 ± 50, and 3380 ± 70 kev. The latter two appear in previously unknown transitions to Ce^{140} levels. The transition intensity to 3110 and 3380 kev is 2.9×10^{-4} and 1.3×10^{-5} per decay. (R.V.J.)

14426

ANISOTROPIC DISTRIBUTION OF INTERNAL BREMSSTRAHLUNG γ QUANTA IN K CAPTURE BY POLARIZED NUCLEI. S. F. Timashev and V. A. Kaminskiĭ (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 284-5(1960) Jan. (In Russian)

The anisotropic angular distribution of internal bremsstrahlung in K capture by polarized nuclei was measured for permissible transitions in the Born approximation for nuclear Coulomb fields. Coefficients of anisotropy for V^{49}, Fe^{55}, Ge^{71}, Mo^{93}, and Cs^{131} are included. (R.V.J.)

14427

ELASTIC PROTON SCATTERING BY CHROMIUM ISOTOPES AT 5.40 Mev. A. P. Klyucharev and N. Ya. Rutkevich (Inst. of Physics and Tech., Academy of Sciences Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 285-7(1960) Jan. (In Russian)

Angular distributions of protons elastically scattered by Cr^{52} and Cr^{53} were recorded at 20 to 160°. Plots of energy spectra indicate not only quantitative but also qualitative differences. At large angles the intensity for Cr^{52} is about 2.5 times than for Cr^{53}. The minima differ greatly at 90°. The even-even Cr^{52} scatters protons in a manner identical to Ni^{58}, Ni^{60}, etc., while the odd-even Cr^{53} scattering is identical to Cu^{65}. The data indicate that regardless of the nucleon charge the one unit change in the number of nucleons alters considerably the nucleon interaction. (R.V.J.)

14428

ANGULAR DISTRIBUTION OF PROTONS IN $Ca^{40}(d,p)Ca^{41}$ REACTION. N. I. Zaika, O. F. Nemetz, and V. S. Prokopenko. Zhur. Eksptl'. i Teoret. Fiz. 38, 287-9(1960) Jan. (In Russian)

Proton angular distributions from $Ca^{40}(d,p)Ca^{41}$ and ground, first, and third states of excitation were measured at deuteron energy of 13.5 Mev. Theoretical and experimental data were plotted for proton angular distributions in ground and excited states at 1.95 and 2.42 Mev. The data are in good agreement with those previously published. It was observed that the background (the angular distribution isotropic section at 13.6 Mev) is smaller than for the case of 7 to 8 Mev deuterons, confirming the increasing role of direct interaction with increase of energy. (R.V.J.)

14429

ANGULAR CORRELATIONS OF 298 TO 880 AND 298 TO 966 Kev γ CASCADES OF Dy^{160}. M. V. Klimentovskaya and G. Chandra (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 290-1(1960) Jan. (In Russian)

The angular correlations of 298 to 966 and 298 to 880 kev cascades were made. The results agree with a transition sequence 2(D)2(D + Q)2. Moreover, the ratio of δ^2 mixtures at 880 kev is ≈56 ($\delta < 0$): hence the intensity of (Ml) dipole γ transitions at 880 kev is (1.8 ± 1.5)% and quadrupole irradiation (E2) is 98.2 ± 1.5%. The results contradict the S. Ofer (Nucl. Phys. 5, 331(1958)) postulation that transition 880 kev is practically pure Q. (R.V.J.)

14430

PRODUCTION OF Cd^{115m} ISOMER IN HEAVY ION GOLD FISSION. S. M. Polikanov and Yu. T. Chuburkov. Zhur. Eksptl'. i Teoret. Fiz. 38, 295-6(1960) Jan. (In Russian)

The fission fragment isomer yield dependence on the magnitude of the fissioning nucleus angular moment was investigated. A general tendency toward increased isomer yield was observed with an increase of incident particle energy. A gold foil target was used for determining the ratio of Cd^{115} and Cd^{115m} yields from Au^{197} bombardment by 78 and 68 Mev C^{12}, 89 Mev N^{14}, and 102 and 85 Mev O^{16} ions. Tabulated data show a Cd^{115} to Cd^{115m} yield ratio of 0.55 and 0.64 for C^{12}, 0.47 for N^{14}, and 0.43 and 0.50 for O^{16} with $l^2{}_{max}$ of 1750 and 530, 2060, and 2700 and 760, respectively. With $l^2{}_{max}$ variation from 500 to 3000, the yield ratio varies very little. (R.V.J.)

14431

RELATIVISTIC PHOTOEFFECT ON L-SHELL. M. Gavrila (Parkhon Univ., Bucharest). Zhur. Eksptl'. i Teoret. Fiz. 38, 309-11(1960) Jan. (In Russian)

Analytical expressions are derived for relativistic photoeffect cross section approximations for light nuclei. The cross sections found for the L_I subshell hold up to the first order αZ (inclusive), while approximations for L_{II} and L_{III} subshells are in zero order of αZ. Calculations are based on the ordinary central coulomb field approximation for separate electrons, replacing Z by $Z_s = Z - 4.5$. (R.V.J.)

14432

ENERGY DISTRIBUTION OF SPUTTERED AND SCATTERED IONS IN THE BOMBARDMENT OF TANTALUM AND MOLYBDENUM BY POSITIVE CESIUM IONS. V. I. Veksler. Zhur. Eksptl'. i Teoret. Fiz. 38, 324-34(1960) Feb. (In Russian)

A method for investigation of the energy spectra of scattered and sputtered ions emitted from metals bombarded with positive ions is described. Investigations were carried out on the energy spectra of Cs^+, Mo^+, and Ta^+ ions obtained by bombarding molybdenum and tantalum targets at T ~ 1600 to 1800°K by Cs^+ ions possessing an energy U of 900 to 2150 ev. The sputtering and scattering components were separated from the previously determined secondary emission ion spectra and the result was a significant decrease of the limiting energy in the scattering spectrum of Cs^+ ions scattered by Mo. In the case of Mo^+ ions, the width of the sputtered ion spectrum was 30 to 35 ev and for Ta^+ ions it was 35 to 50 ev. (auth)

14433

FRAGMENTATION OF Ag AND Br NUCLEI BY 9-Bev PROTON ENERGY. N. A. Perfilov, N. S. Ivanova, O. V. Lozhkin, M. M. Makarov, V. I. Ostroumov, Z. I. Soloveva, and V. P. Shamov. Zhur. Eksptl'. i Teoret. Fiz. 38, 345-50(1960) Feb. (In Russian)

Formation of multicharged particles with $Z \geq 4$ due to interaction of 9 Bev protons with Ag and Br nuclei in photographic emulsions was investigated. The fragment production cross section, and the angular, energy, and charge distribution of the fragments were determined. The peculiarities of nuclear disintegrations involving the formation of fragments were examined. (auth)

14434

INVESTIGATION OF THE (α, α'), (α, p), AND (α, t) REACTIONS ON LITHIUM NUCLEI. K. V. Makaryunas and S. V. Starodubtsev. Zhur. Eksptl'. i Teoret. Fiz. 38, 372-8 (1960) Feb. (In Russian)

The angular distribution of the reaction $Li^7(\alpha, \alpha')Li^{7*}$ (Q = −4.61 Mev) was investigated at 13.2 Mev. The angular distributions of the reactions $Li^7(\alpha, t)Be^8$ (Q = −2.56 Mev), $Li^6(\alpha, p)Be^9$ (Q = −2.13 Mev), and $Li^7(\alpha, p)Be^{10}$ (Q = −2.56 Mev) were determined at 10.15, 11.5, and 13.2 Mev, respectively. The results were derived from direct interaction theories. From an interpretation of the experimental angular distribution of the reaction (α, α') within the framework of Butler's theory it is shown that the parity of the 4.61 Mev level in the Li^7 nucleus is negative and the spin is equal to one of the following four values: $\frac{1}{2}$, $\frac{3}{2}$, $\frac{5}{2}$, or $\frac{7}{2}$. (auth)

14435

POSITRON DECAY OF Ir^{192}. S. F. Antonova, S. S. Vasilenko, M. G. Kaganskii, and D. L. Kaminskii. Zhur. Eksptl'. i Teoret. Fiz. 38, 379-83(1960) Feb. (In Russian)

The positron decay of Ir^{192} was studied ($T_{\frac{1}{2}}$ = 74 days). Relative decay intensity amounted to 1.5×10^{-7} positrons per decay. End-point energy of the β^+ spectrum E_0 was 240 ± 10 kev. The total transition energy of $Ir^{192}-Os^{192}$ equaled 1950 kev. Measurements were made of the conversion electron spectrum in the energy region of greater than 1 Mev. A γ-transition was discovered with an energy of 1088 kev (auth)

14436

Th^{232} FISSION INDUCED BY 14.9-Mev NEUTRONS. A. N. Protopopov, M. I. Kuznetsov, and E. G. Dermendzhiev. Zhur. Eksptl'. i Teoret. Fiz. 38, 384-6(1960) Feb. (In Russian)

The energy characteristics of Th^{232} fission induced by 14.9 Mev neutrons were measured using a double ionization chamber with a grid. The most probable total kinetic energy and fragment mass ratio were measured and found equal to 157 ± 4 Mev and 1.43 ± 0.05, respectively. The most probable values of the masses of the heavy and light fission fragments were determined to be 140 ± 3 and 92 ± 3, respectively. Data were obtained which confirm the influence of nuclear shells on fission. (auth)

14437

ON THE MECHANISM OF URANIUM FISSION INDUCED BY SLOW μ^--MESONS. G. E. Belovitskiĭ, N. T. Kashchukeev, A. Mikhul, M. G. Petrashku, T. A. Romanova, and F. A. Tikhomirov. Zhur. Eksptl'. i Teoret. Fiz. 38, 404-8(1960) Feb. (In Russian)

Photographic emulsions were employed to study the possibility of uranium fission produced as a result of direct transfer to the nucleus of the energy liberated in the 2p—1s mesic atom transition. The upper limit of the probability for fission by this mechanism was determined to be ~0.01. The μ^--meson induced fission of uranium nuclei was found to be mainly due to nuclear capture of the μ^--meson, the probability for this being of the order of 0.07. The possibility that the mesic atom 2p—1s transition in uranium is partially a radiationless transition is discussed. (auth)

14438

INELASTIC INTERACTION OF π^+-MESONS WITH HELIUM NUCLEI AT AN ENERGY OF ABOUT 300 MeV. M. S. Kozodaev, M. M. Kulyukin, R. M. Sulyaev, A. I. Filippov, and Yu. A. Shcherbakov. Zhur. Eksptl'. i Teoret. Fiz. 38, 409-22(1960) Feb. (In Russian)

The interaction of positive and negative π-mesons with helium nuclei at energies of 273 and 330 Mev was studied using a diffusion cloud chamber. Quasifree scattering on neutrons and protons, multiple scattering, and absorption of the mesons were discriminated. The total inelastic interaction cross sections were $(145 \pm 15) \times 10^{-27}$ cm^2 for $E_\pi = 273$ Mev and $(103 \pm 10) \times 10^{-27}$ cm^2 for $E_\pi = 330$ Mev. The relative probabilities for quasifree scattering on neutrons and protons through angles >45° in the laboratory coordinate system were found to agree with the corresponding probabilities for scattering on free nucleons. The probabilities for multiple scattering processes were found to be 0.24 ± 0.06 for $E_\pi = 273$ Mev and 0.29 ± 0.05 for $E_\pi = 330$ Mev. The angular distribution of inelastically scattered π-mesons was compared with the Watson—Zemach calculations. (auth)

14439

NON-MESON DECAYS OF HYPERFRAGMENTS. I. B. Berkovich, A. P. Zhdanov, F. G. Lepekhin, and Z. S. Khokhlova. Zhur. Eksptl'. i Teoret. Fiz. 38, 423-5(1960) Feb. (In Russian)

Non-mesonic decays of 18 hyperfragments were studied in an emulsion stack irradiated with 4.5 Bev π-mesons. The ratio of the number of decays due to the interaction between the Λ^0-particle and neutron to the number of decays due to interaction with a proton was determined to be 1.25. (auth)

14440

EXCITATION OF NUCLEAR COLLECTIVE STATES IN CHARGED PARTICLE SCATTERING. S. I. Drozdov. Zhur. Eksptl'. i Teoret. Fiz. 38, 499-502(1960) Feb. (In Russian)

The differential excitation cross section of the 4^+ even-even nucleus collective level in fast nucleon small-angle scattering is derived. The cross section is shown to depend strongly on the absolute value and sign of the nuclear shape parameter α_4. (auth)

14441

SPECTRA OF γ-RAYS PRODUCED IN THE CAPTURE OF THERMAL NEUTRONS BY HEAVY NUCLEI. [PART] I. L. V. Groshev, A. M. Demidov, and V. I. Pelekhov. Zhur. Eksptl'. i Teoret. Fiz. 38, 588-97(1960) Feb. (In Russian)

Experimental data on the γ-spectra from the thermal neutron (n,γ) reaction are compared with theoretical spectra calculated for two laws of variation of the level density. The effect of the energy gap in the level spectrum of even-even nuclei on the γ-ray spectrum in the 0.8 to 4 Mev region is discussed. The presence of an energy gap leads to large difference in the spectra of odd-odd and even-even nuclei. (auth)

14442

SPECTRA OF γ-RAYS PRODUCED IN THE CAPTURE OF THERMAL NEUTRONS BY HEAVY NUCLEI. [PART] II. V. M. Strutinskiĭ, L. V. Groshev, and M. K. Akimova. Zhur. Eksptl'. i Teoret. Fiz. 38, 598-611(1960) Feb. (In Russian)

The spectra of γ-rays accompanying the capture of thermal neutrons are calculated. The calculations were performed for dipole γ-radiation and two types of dependence of the nuclear level density on energy. The results for the level density are compared with data derived from other experiments. (auth)

14443

CIRCULAR POLARIZATION OF γ-QUANTA ACCOMPANYING NUCLEAR CAPTURE OF SLOW NEUTRONS. D. P. Grechukhin. Zhur. Eksptl'. i Teoret. Fiz. 38, 621-30(1960) Feb. (In Russian)

An estimation was made of the order of magnitude of the polarization and anisotropy of the angular distribution of cascade quanta emitted by a previously polarized compound nucleus. A determination of the average of the circular polarization over the cascade established the spin of the initial state of the compound nucleus. The spectral distribution of the polarization and anisotropy of the angular distribution of the quanta were studied. (auth)

14444

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE NUCLEAR OPTICAL MODEL, MARCH 16 AND 17, 1959, FLORIDA STATE UNIVERSITY, TALLAHASSEE, FLORIDA. Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959. 292p.

A conference on the nuclear optical model was held at the Florida State University in Tallahassee on March 16 and 17, 1959. The purpose of the conference was to assemble scientists actively engaged in large-scale optical model calculations in order to compare techniques, ideas, and results and make other interchanges helpful toward advancing the understanding of this model of the nucleus. Separate abstracts were prepared for fifteen papers. (W.D.M.)

14445

PHENOMENOLOGICAL ANALYSIS WITH SPHERICAL POTENTIALS. F. Bjorklund (Univ. of California, Livermore). p.1-15 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Some representative work on phenomenological analysis of nucleon-nuclear scattering with spherical potentials is discussed to determine the current trends in this field. General characteristics of the optical potentials as a function of energy are considered. Curves are presented which were compiled using potentials of the surface absorption type at low energies (below 50 Mev) and volume absorption at energies above this. (W.D.M.)

14446

THE INFLUENCE OF DETAILS OF THE POTENTIAL. J. S. Nodvik (Univ. of Southern California, Los Angeles). p.16-33 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

In spite of its shortcomings in some energy regions and in some parts of the periodic table, the optical model with spin-orbit coupling seems to provide a rather remarkable accounting for a large mass of experimental data on nuclear polarization and cross sections. The question of what the experimental data can actually determine about the shape of the nuclear potential is discussed. The interactions of 9.75- and 135-Mev protons on copper and silver are considered. (W.D.M.)

14447

INFLUENCE OF SPHEROIDAL DEFORMATION. B. Margolis (Columbia Univ., New York). p.34-43 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

The regions of A where nuclei have large quadrupole deformations have been studied intensively in the last few years. In the Bohr-Mottelson collective model the nucleons moved in a deformed nuclear well. Associated with these deformations are collective motions in the form of rotations and vibrations. The effect of this nonsphericity on the scattering of particles from these nuclei is studied. The state of this work is summarized with special emphasis on neutron scattering. (W.D.M.)

14448

BOUND STATES AND THE OPTICAL MODEL. A. E. S. Green (Florida State Univ., Tallahassee). p.44-62 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Work is reported on the nucleon—nuclear potential in studies parallel to the optical model studies of negative energy states of nucleons in nuclei. An attempt to combine the two models is made. (W.D.M.)

14449

SURVEY OF POLARIZATION EXPERIMENTS. L. Rosen (Los Alamos Scientific Lab., N. Mex.). p.72-103 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

A survey of polarization experiments is presented. Representative results at various energies are shown, and the extent to which optical model calculations have been able to describe these results is indicated. Polarization experiments may be described as comprising the scattering of polarized nucleons by target nuclei. Experimental data presented were obtained in double-scattering experiments. (W.D.M.)

14450

INELASTIC SCATTERING AT LOW ENERGIES. C. A. Levinson (Princeton Univ., N. J.). p.104-31 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

The various theoretical attempts to explain inelastic scattering of nucleons on nuclei are discussed. In order to describe the various approaches that have been used and are being contemplated, an expression is given for the total wave function of a process in which there is one nucleon coming in and one nucleon going out and which leaves the nucleus excited or in its ground state. (W.D.M.)

14451

INELASTIC SCATTERING, HIGH ENERGIES. Th. A. J. Maris (Florida State Univ., Tallahassee). p.132-44 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Some inelastic scattering experiments done with protons at energies of about 100 Mev or more are reported. Experimental results of the usual type of inelastic scattering are given in which the bombarded nucleus is excited but stays intact sufficiently long to have a well defined energy. Some other experiments are discussed in which one proton is knocked out from the original nucleus and interest is in the states of the residual system. (W.D.M.)

14452

THE STRUCTURE OF A FINITE NUCLEUS. K. A. Brueckner (Univ. of Pennsylvania, Philadelphia). p.145-60 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

The problem of proceeding from the two-body interactions to the theory of the many-body system and particularly to the theory of the finite system of the optical model is considered. Work on the theory of the finite nucleus and calculations on the finite nucleus are discussed. (W.D.M.)

14453

FINE STRUCTURE AND GROSS STRUCTURE. A. M. Lane (Atomic Energy Research Establishment, Berks, Eng.). p.161-77 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

At low energies where fine structure occurs, the most physically significant definition of the potential is that which reproduces the cross sections averaged over resonance levels. On a practical level it is evident that by selectively averaging the fine structure data, one can often obtain more information than is made available by a poor resolution experiment. Various kinds of data and the extraction of physically significant quantities from them are discussed. (W.D.M.)

14454
ON THE JUSTIFICATION OF THE OPTICAL MODEL. C. Bloch ([Centre d'Etudes Nucléaires,] Saclay, France). p.178-83 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

It is convenient to use a form of the theory of nuclear reactions very similar to the Lippman-Schwinger scattering theory for justification of the optical model. The difference is that instead of using a formal solution of the Schroedinger equation in the whole configuration space, one uses a formal solution of this equation in a limited region: the internal region in which all nucleons of the system interact with each other. (W.D.M.)

14455
THE OPTICAL MODEL AT HIGH ENERGIES. R. J. Glauber (Harvard Univ., Cambridge, Mass.). p.184-94 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

Work is described which is part of a fairly general attempt to understand from a fundamental plane what goes into the optical model. The method hinges on a number of approximations which all have the character that they limit the considerations to high energies. Fraunhofer or Kirchhoff diffraction theory is used. (W.D.M.)

14456
THE JUSTIFICATION OF THE OPTICAL MODEL. Herman Feshbach (Massachusetts Inst. of Tech., Cambridge). p.195-205 of "Proceedings of the International Conference on the Nuclear Optical Model, March 16 and 17, 1959, Florida State University, Tallahassee, Florida." Alex E. S. Green, Charles E. Porter, and David S. Saxon, eds. The Florida State University Studies, Number Thirty-Two. Tallahassee, Florida, The Florida State University, 1959.

The low-energy situation is considered where the term "complex potential model" is somewhat more descriptive than "optical model." The Hamiltonian is written in terms of the Hamiltonian of the target (H_0) nucleus and an interaction between the incident nucleon and the target nucleus. An expansion is introduced in terms of the eigenstates of H_0. (W.D.M.)

Particle Accelerators

14457 DESY-A-2.58
Deutsches Elektronen-Synchrotron, Hamburg. BEOBACHTUNG DER ELEKTRONENBAHNEN MIT HILFE DER SYNCHROTRON-STRAHLUNG. TEIL I. (Observation of the Electron Path Using Synchrotron Rays. Part I). Krolzig. Mar. 28, 1960. 18p.

There is a possibility that synchrotron radiation can be used for measurement of the electron beam cross section at one or more points within the ring-shaped vacuum chamber of DESY. A discussion is presented on the image characteristics, energy correlation in conjunction with the need for exposure, and dependence on wavelength of the radiation used. (T.R.H.)

14458 DESY-A 2.59
Deutsches Elektronen-Synchrotron, Hamburg. NUMERISCHE BEHANDLUNG DES BEAM-LOADING PROBLEMS BEIM HOCHFREQUENZ-SYSTEM. (Numerical Treatment of the Beam-loading Problems of High-frequency Systems). Armin Hermann. Mar. 28, 1960. 16p.

The circumferential voltage in a synchrotron rises from 280 kv to 5 or 6 mv at 6 Bev. For a 125-milliamp injected beam a potential of 15 mv is induced in the building-up condition at resonance. The time for the building-up process is, in this case, about 100 μsec. Thus an initial potential of 1 or 2 mv results in induced potentials of 15 mv. Two mathematical treatments of this problem are given. (T.R.H.)

14459 TID-5783
Midwestern Universities Research Assn., Madison, Wis. QUARTERLY REPORT OF THE LABORATORY DIRECTOR FOR THE PERIOD APRIL 1, 1959 TO JUNE 30, 1959. 6p. OTS.

Major components of the two-way model accelerator and field measurements for all magnets were completed. Correction coils were constructed and tested to compensate for the variation of the field with radius. The quadrants of the vacuum tank were completed and tests indicate that a vacuum of better than 10^{-7} mm of mercury in the tank will be possible. Completion of the injector design is reported. (See also AECU-4446.) (C.J.G.)

14460
A CYCLOTRON WITH A SPATIALLY VARYING MAGNETIC FIELD. D. P. Vasilevskaya, A. A. Glazov, V. I. Danilov, Yu. N. Denisov, V. P. Dzhelepov, V. P. Dmitrievskii, B. I. Zamolodchikov, N. L. Zaplatin, V. V. Kol'ga, A. A. Kropin, Nei-ch'uan Liu, V. S. Rybalko, A. L. Savenkov, and L. A. Sarkisyan. Atomnaya Energ. 8, 189-200(1960) Mar. (In Russian)

The linear theory of charged-particle movement in magnetic fields with periodic structure along the radius and azimuth was evolved. The theoretical and experimental results on non-linear resonance near the center of the accelerator are analyzed. Formulas are derived for calculating the required magnetic field configurations. The shimming, measuring, and field stabilization methods are described. An accelerator with 120-cm poles was used in modeling ion motions and studying spatial stability. (tr-auth)

14461
ACCELERATION OF IONS IN A CYCLOTRON WITH AN AZIMUTHALLY VARYING MAGNETIC FIELD. R. A. Meshcherov, E. S. Mironov, L. M. Nemenov, S. N. Rybin, and Yu. A. Kholmovskii. Atomnaya Energ. 8, 201-8(1960) Mar. (In Russian)

Experiments involving accelerations of charged particles in magnetic fields with azimuthal variation were conducted in a 1.5-meter cyclotron. A sector-type magnetic field with depth variation ~±15% and ~15 kw between dees accelerated deuterons up to 19 Mev. The ion motion in finite orbits indicates the possibility of emitting larger ion beams considerably exceeding 20 Mev by means of an electrostatic deflecting system. The characteristics of acceleration in magnetic fields with azimuthal variation were plotted. Magnetic field corrections by windings inside the acceleration chamber are analyzed. (tr-auth)

14462
MODIFICATION WITH TIME OF THE STRUCTURE OF THE BEAM OF THE SYNCHROCYCLOTRON. André Carbrespine. Compt. rend. 250, 2544-6(1960) Apr. 4. (In French)

The conditions for the utilization of the external beam of a synchrocyclotron for experiments of nuclear physics can be considerably improved by multiplying the number of particle jets with an electronic apparatus acting on the final trajectories. (tr-auth)

14463

LABORATORIES FOR THE VAN DE GRAAFF ACCELERATOR OF THE INSTITUTE OF NUCLEAR RESEARCH OF THE CZECHOSLOVAK ACADEMY OF SCIENCES. Igor Chochlovský, Vladimír Kufner, and František Nový (State Univ., Prague). Jaderná energie 6, 80-2(1960). (In Czech.)

A description is presented of the arrangement and equipment in the laboratories which contain the 5-Mev Van de Graaff accelerator at the Czechoslovak Academy of Sciences. The accelerator is a vertical type contained in a pressure vessel and was built in the Institute of Nuclear Research. (B.O.G.)

14464

BOLTZMANN EQUATION FOR AN ELECTRON GUIDE FIELD ACCELERATOR. II. STABILITY ANALYSIS FOR AN ELECTRON BEAM. Joachim B. Ehrman (U. S. Naval Research Lab., Washington, D. C.). Phys. Fluids 3, 303-17(1960) Mar.-Apr.

The short time behavior of the quasi-stationary solution of an earlier paper is investigated by linearizing the Boltzmann equation in the perturbations. By the use of a suitable boundary condition on the distribution function in phas space, four one-dimensional coupled inhomogeneous Fredholm equations of the second kind are obtained for Fourier components of the Laplace transforms with respect to time of the perturbation charge-current density components. The asymptotic time behavior of the perturbations is determined by that root of the Fredholm determinant (considered as a function of s, the Laplace transform variable) whose real part is algebraically greatest, provided that this real part is nonnegative. If the real part is negative, then the asymptotic time behavior is sometimes determined by this root of the determinant and sometimes by branch points of the kernel on the imaginary axis. If the determinant has no roots for Re s > 0 and no multiple roots for Re s = 0, the quasi-stationary solution is stable. For the azimuthally symmetric Fourier components, the equation for ρv_θ is not coupled to the others and is studied in more detail. In the approximate betatron regime, the Landau damping rate for this mode is estimated without use of the Fredholm determinant. In the extreme betatron regime, the undamped vibration frequencies are obtained. (auth)

14465

MAGNETIC FIELD DISTORTIONS IN STRONG FOCUSING ACCELERATORS. Yu. M. Goryachev, S. V. Skachkov, and T. G. Smolyankina. Pribory i Tekh. Ekspt. No. 6, 13-17 (1959) Nov.-Dec. (In Russian)

Descriptions are given of an installation for rapidly determining magnetic field gradient in strong-focusing accelerators. The error in relative distortion measurements during injection is $\sim 10^{-3}$, and at the finish of the working cycle it is down to 5×10^{-4}. Data are also given on the correction winding producing the surface pole current. (tr-auth)

14466

AUTOMATIC TRIMMERS FOR CYCLOTRON RESONANCE SYSTEM REACTIVE PARAMETERS. A. V. Antonov, Yu. V. Korshunov, E. A. Meleshko, and V. S. Panasyuk. Pribory i Tekh. Ekspt. No. 6, 20-4(1959) Nov.-Dec. (In Russian)

Descriptions are given of the design and performance of a high-frequency amplitude difference stabilizer for dee potentials and of the cyclotron resonance automatic trimmers in generator frequency. Performance of the automatic control of the installation was tested. (tr-auth)

14467

CYCLOTRON ION SLIT SOURCE. I. I. Afanas'ev, L. F. Kondrashev, L. N. Mikhaĭlov, and A. I. Nastyakha. Pribory i Tekh. Ekspt. No. 6, 25-7(1959) Nov.-Dec. (In Russian)

The design of a cyclotron slit source with electron oscillations is presented. The source was used for producing H^+, H_2^+, and D^+ ions. The source contributed to cyclotron performance and stability. (tr-auth)

14468

MEASUREMENTS OF ION BEAM WIDTH NEAR CYCLOTRON SOURCE. N. D. Fedorov and Yu. A. Kholmovskiĭ. Pribory i Tekh. Ekspt. No. 6, 27-9(1959) Nov.-Dec. (In Russian)

Measurements were made of the ion beam width in a 1.5 m cyclotron at the first dee entrance (after first acceleration). The results are in good agreement with approximations, based on a homogeneous electric field between the source and dee, a starting phase region from −10 to +30°, and an initial ion range of zero. Thus, in the case of ion slit source the distortions of the electric field by plasma pinch do not have to be considered and calculations of the central cyclotron region may be made with ordinary equations. (tr-auth)

14469

MEASUREMENTS OF PHASE WIDTH OF ELECTRON BUNCHES ACCELERATED IN LINEAR ACCELERATOR. I. A. Grishaev, V. I. Kolosov, B. V. Yakimov, V. I. Myakota, and A. I. Zhdanov (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Pribory i Tekh. Ekspt. No. 6, 30-2(1959) Nov.-Dec. (In Russian)

A method is suggested for measuring phase widths of non-monoenergetic electron bunches accelerated to 2.2 Mev in a linear accelerator. The order of accuracy is 30% with a phase width of 17°. (tr-auth)

14470

COLD CATHODE INJECTOR FOR BETATRONS. G. D. Kuleshov and A. I. Pavlovskiĭ. Pribory i Tekh. Ekspt. No. 6, 119-20(1959) Nov.-Dec. (In Russian)

Descriptions are given of an injector with a pulsed cold cathode, based on the high-vacuum breakdown principle. With 0.2-μsec pulse times and 10 to 25 kv, currents of several amps are easily injected. (tr-auth)

14471

EPOXY REPLACES QUARTZ IN HIGH-VACUUM "DOUGHNUT." James O. Turner (Univ. of California, Berkeley). Research/Develop. 11, 16-17(1960) May.

Epoxy resin was used successfully as the material of a segment manufactured for an annular vacuum tank for the Lawrence Radiation Laboratory's 340-Mev electron synchrotron. It offers an important advantage over quartz: it is less breakable and can be machined easily for the ports and windows required for various radiation experiments. The development of epoxy resin fabrication procedure and the problem involved are described. The final procedure consists of coring the mold with polystyrene foam and adding the epoxy resin solution with fiberglass laminating to increase resistance to vacuum stress. The joints resulting from attaching the epoxy resin segment to the quartz segments were sealed with neoprene rubber boots. (D.L.C.)

14472

INVESTIGATION OF ELECTRON DISTRIBUTION IN BETATRON VACUUM CHAMBER. S. G. Denisov, D. P. Ivanov, A. P. Komar, and Yu. S. Korobotshko (Leningrad

Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 30, 31-6 (1960) Jan. (In Russian)

Electron charge distribution within the betatron chamber was investigated. (R.V.J.)

14473

STABILIZATION OF INTENSITY OF γ-RAY RADIATION IN BETATRON AND SYNCHROTRON. G. F. Micheev and N. N. Chernov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz 30, 37-40(1960) Jan. (In Russian)

The beam control and working scheme are described for synchrotrons in which stabilization is achieved by a reverse relationship between the magnitude of intensity and one of the synchrotron parameters. (R.V.J.)

14474

COMPACT ELECTROSTATIC 1.5 MEV ACCELERATOR. L. I. Pivovar, V. M. Tubaev, and M. T. Novikov. Zhur. Tekh. Fiz. 30, 74-81(1960) Jan. (In Russian)

Descriptions are given of the construction and testing of a 1.5-Mev accelerator operating in compressed gas. The accelerator produced 1.55-Mev hydrogen ions with potential gradient along the acceleration tube of nearly 2 mw/m. (tr-auth)

Plasma Physics and Thermonuclear Processes

14475 AERE-T/R-2247

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE KINETIC THEORY OF AN IONIZED GAS. W. Marshall. May 1957. 59p.

The Boltzmann equation for a simple gas is derived and its limitations discussed. Hydrodynamic equations are derived from the Boltzmann equation, and the pressure tensor and heat flux vector are introduced. A discussion of collisions and the form in which they enter into the Boltzmann equation are given. Expressions are derived for the rate of change of any quantity due to collisions. A proof is given of the statement: if left alone, the gas will approach the equilibrium state described by a Maxwell distribution. Properties of this equilibrium state are discussed. The physical significance of various terms of the hydrodynamic equations is discussed. The simple "mean free time" theory is described. The formal procedure of Chapman and Cowling for obtaining a solution of the Boltzmann equation is described. The variation method of Hirshfelder et al. for solving the integral equations which turn up in the theory is described, and the coefficients of viscosity and thermal conduction are calculated. (C.J.G.)

14476 AERE-T/R-2352

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

KINETIC THEORY OF AN IONIZED GAS. PART II. W. Marshall. Dec. 1957. 50p.

The Boltzmann equations for the two components of a plasma are given and the equations of hydrodynamics for a binary gas are derived. Collisions of unlike particles are treated. It is shown that if the system is left alone, it will approach an equilibrium state in which the distribution functions are of the Maxwell form. A solution of the Boltzmann equation by the Chapman-Cowling procedure (successive approximations) is given and expressions for the coefficients of viscosity, thermal conduction and electric conductivity were derived. The variation method of Hirschfelder et al. is described and applied to the calculation of the above coefficients. (For Part I see AERE-TR-2247). (C.J.G.)

14477 AFOSR-TN-59-427

Plasmadyne Corp., Santa Ana, Calif.

FUSION POWER. VOLUME VI. FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. Emil J. Hellund. Apr. 24, 1959. 70p. Contract AF49(638)-332. (E-6FR049-332(Vol. VI); AD-214777).

The application of fusion power to space vehicle propulsion is considered. Types of fusion reactors discussed include toroidal stabilized pinch, linear pinch, stellarators, astron, adiabatic trap devices, and rotating plasmas. (W.D.M.)

14478 JPL-TR-32-2

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

ON THE ENERGY EQUATION IN MAGNETOGASDYNAMICS. Ching-sheng Wu. Jan. 7, 1960. 37p. Contract NASw-6.

The formulation of the energy equation in magnetogasdynamics or magnetoplasmadynamics based on a multicomponent model is considered. For an ionized gas, the classical macroscopic formulation is found to be incomplete, because the diffusion phenomena which play important roles in the energy transport process were neglected. An attempt is made to discuss the new energy equation—based entirely on macroscopic theory—without going into the so-called kinetic theory. Therefore, no special microscopic model is necessary. The entire discussion is given in a straightforward manner, and the description was made as simple as possible. (auth)

14479 NP-8414(Pt.V.)

Convair, San Diego, Calif.

NON-LINEAR PLASMA EFFECT. S. Rand. June 18, 1959. 23p. (Ph-050-M)

Recent linearized studies of plasma motions induced by a line charge are extended to include the effect of a particular non-linear effect. The assumption which allows for a linearization of the plasma ion density is discarded. The resulting potential field in the plasma is determined over a limited region of space by using both the particle method and the fluid dynamics equations. These solutions are compared with that obtained by the linear approach. (auth)

14480 NP-8414(Pt.VII)

Convair, San Diego, Calif.

CHARGE EXCITATION OF PLASMA MOTION IN A MAGNETIC FIELD. R. A. Pappert. July 6, 1959. 26p. (ZPh-025)

The wake of a massive point charge traversing a low-density plasma of vanishing ion temperature, in a constant external magnetic field, is investigated by means of linearized Boltzmann theory. The speed of the exciting charge is taken to be less than the root mean square thermal speed of the electrons and the electron thermal energy is taken to be much less than the ion energy associated with the ambient flow velocity; that is, the ion flow velocity as seen in a reference frame moving with the external charge. The magnetic field is taken along the direction of motion of the exciting charge. One of the effects of the magnetic field is the the production of oscillations of both the charge density and the potential. Over some regions of space the frequency of these oscillations is approximately equal to the ion cyclotron frequency. (auth)

14481 NP-8546
[Borg-Warner Corp. Research Center, Des Plaines, Ill.].
PULSED PLASMA PROPULSION. AN ADVANCED REACTION PROPULSION SYSTEM. Interim Progress Report [for Period] January 1, 1960 to March 31, 1960. T. L. Thourson. Apr. 5, 1960. 14p. Contract AF33(616)-6036.

Considerable data were collected on impulse versus total energy for a simple rail accelerator and a loop-type accelerator. With the delivery of the third Tobe Deutschmann energy storage capacitor, the total stored energy was increased to 3000 joules. A reasonably valid simplification of the differential equations describing these accelerators permits a direct computation of the final velocity imparted to the plasma. The fact that there are no magnetohydrodynamics in these equations limits their usefulness to evaluating the effect of circuit parameters. A summary of the approach to the systems analysis is presented. (For preceding period see NP-8235.) (auth)

14482 NP-8580
General Electric Co. Research Lab., Schenectady, N. Y.
HIGH MAGNETIC FIELD PRODUCTION WITH MILLISECOND AND MICROSECOND RISE TIMES. W. F. Westandorp. Feb. 15, 1960. 11p.

The research on fusion was centered around two experimental installations: the first one was a mirror configuration with a field rising in 6.5 milliseconds, and the second one was a fast compression experiment with a rise time of 3.5 microseconds. The particular magnetic field generation in these assemblies is discussed. (W.L.H.)

14483 NP-8590
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
TRANSVERSE PINCH OSCILLATIONS. Burton D. Fried. Mar. 24, 1960. 10p. Contract AF04(647)-309. (STL/TN-60-0000-09059).

It is shown that the oscillations or "bouncing" of a transverse pinch is predicted by a simple model in which no trapped magnetic field is assumed. An equation is derived which predicts behavior of the oscillation frequency in a linear approximation. (C.J.G.)

14484 NP-8622
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
HARDNESS OF THE AXIALLY-SYMMETRIC MAGNETIC PISTON. Allan B. Schaffer. Jan. 8, 1960. 30p. Contract AF04(647)-309. (STL/TR-60-0000-09011).

A magnetic field travelling down a transmission line is to be used as a magnetic piston to compress plasma. The effect of plasma leakage through the magnetic piston is considered by means of an order-of-magnitude treatment of the momentum equation. An expression which gages the leakage is derived. The leakage was found to vary inversely as the magnetic Reynolds number. Expressions are derived for the temperature and electrical conductivity of the plasma behind the normal shock. (auth)

14485 SIT-P1
Stevens Inst. of Tech., Hoboken, N. J.
PLASMA MOTION ACROSS MAGNETIC FIELDS. George Schmidt. Mar. 1960. 20p. Contracts AF19(604)-4086 and AT(30-1)-1921. OTS.

An attempt is made to give a simple description of plasma motion on the basis of a simplified model, using the guiding center approximation to describe the motion of particles and a self-consistent field treatment to describe the electromagnetic field generated by the plasma. It is assumed that the plasma is collisionless, of low β, and that all dimensions are large compared to the cyclotron radii. The method is illustrated by treating some simple problems of interest. (W.D.M.)

14486 UCRL-5789-T
California. Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL COMPUTATIONS FOR SELF-CONSISTENT ASTRON E LAYER WITH SLOWING DOWN OF ELECTRONS. T. Seidman. Nov. 1959. 10p. Contract W-7405-eng-48. OTS.

14487 UCRL-8775
California. Univ., Berkeley. Lawrence Radiation Lab.
CONTROLLED THERMONUCLEAR RESEARCH QUARTERLY REPORT [FOR] MARCH, APRIL, MAY 1959. June 10, 1959. 103p. Contract W-7405-eng-48. OTS.

Components of the program not specifically covered in the preceding report are brought up to date. Elements of the program in which no significant results were produced are mentioned only briefly. Activities are reported under the following headings: Pyrotron Program; High-energy Injection; Astron Program; Livermore Pinch Program; Berkeley Pinch Program; Ion Magnetron; Theoretical Research; Basic Experimental Research; and Engineering and Technological Development. (For preceding period see UCRL-8682.) (W.D.M.)

14488 WADD-TR-59-486(Pt. III)
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
A DISCUSSION OF TWO IMCOMPRESSIBLE MAGNETOHYDRODYNAMIC FLOWS. PART III. Keith P. Kerney. Oct. 1959. 61p. Project No. 7073. Contract AF33(616)-5693. (MIT-NSL-TR-399). OTS.

The approximate solutions to problems involving the flow of an incompressible viscous fluid having low electrical conductivity through a transverse magnetic field are presented. It is shown that the effects of the Hall current and ion slip can be incorporated into the continuum solution, to a first order, and that the effects of induced properties are of the order of magnetic Reynolds number. Another problem involves the Falkner-Skan flow; it is shown that the external magnetic field must be of the order of the square root of the velocity divided by the length for similar solutions to exist. Further analysis shows that, unless the conductivity vanishes outside the boundary layer, the class of magnetic fields required for similar solutions leads to singularities in the external field. (auth)

14489
SUPERPOSABILITY IN MAGNETOHYDRODYNAMICS. [PART] II. J. N. Kapur (Delhi Univ.). Appl. Sci. Research 9A, 139-47(1960). (In English)

The concept of superposability of hydromagnetic flows has been discussed by Kapur. The results are used to discuss: (i) superposability of wave motions, (ii) hydrostatic equilibrium of magnetic stars, (iii) effects of viscosity in axially symmetric hydromagnetic flows, (iv) axially symmetric force-free fields, and (v) general force-free fields. (auth)

14490
ENERGY CONSIDERATIONS IN MAGNETOHYDRODYNAMICS. Giovanni Carini. Atti acad. nazl. Lincei Rend., Classe sci. fis., mat. e nat. 27, 48-53(1959) July-Aug. (In Italian)

The energy equations for the magnetohydrodynamic phenomena in the system constituted by the Navier-Poisson equations and the Minkowski equations were derived approximately to first order terms in $\beta = v/c$ (where v is the velocity of any particle in the medium and c is the velocity of light in a vacuum). The case in which the motion of the τ portion is obtained from a lagrangian view is considered. (J.S.R.)

14491

THE FOKKER-PLANCK EQUATION OF A PLASMA. Mircea Drăganu. Compt. rend. 250, 2519-20(1960) Apr. 4. (In French)

The Fokker-Planck equation of a plasma in polar coordinates without azimuthal symmetry was deduced from the general formulas given by Rosenbluth, MacDonald, and Judd. (tr-auth)

14492

DYNAMIC ACTIONS, ON AN OBSTACLE, OF A CONDUCTING LIQUID IN MOTION IN THE PRESENCE OF A MAGNETIC FIELD. Étienne Crausse and Yves Poirier (Faculté des Sciences, Algiers). Compt. rend. 250, 2533-5(1960) Apr. 4. (In French)

The pressures exerted on an obstacle by a conducting liquid in motion and the corresponding friction coefficient can be modified considerably by the presence of a magnetic field. (tr-auth)

14493

SOME ASPECTS OF THE THERMONUCLEAR INVESTIGATION. José Lozano. Energia nuclear (Madrid) 4, No. 13, 35-43(1960) Jan.-Mar. (In Spanish)

A brief review is given of the general methods used in the heating and confinement of plasma. Some apparatus used for experimental study of plasma and the results obtained are also described. (J.S.R.)

14494

DISPERSION FORMULAS FOR ELECTRON PLASMA IN MAGNETIC FIELD. L. I. Podlubnyi (Odessa Pedagogical Inst.). Fiz. Metal. i Metalloved. 8, 796-8(1959) Nov. (In Russian)

Variations in electron plasma oscillations in a constant homogeneous field are analyzed with Green's electron-hole dispersion equation. (R.V.J.)

14495

NEW EXPERIMENTAL RESULTS FOR PLASMA ELECTRON OSCILLATIONS. D. W. Mahaffey (Queen's Univ., Belfast). J. Electronics and Control (1) 6, 193-203(1959) Mar.

Experimental investigations are reported on plasma electron oscillations in low-pressure mercury vapor discharges with plane oxide coated cathodes. The appearances of some of the discharges are described. The primary electrons were deviated laterally in or near the meniscus-shaped region of ionized gas brighter than the surrounding plasma, which appeared a few millimeters from the cathode. Variation of anode-cathode separation was found to have a marked effect on both the appearance of the deflected beams and the meniscus, and on the high-frequency oscillatory properties of the discharges. Measurements of plasma electron concentration and temperature were made simultaneously with measurements of oscillation intensity and frequency. A strong tendency was found for the oscillations to grow in amplitude when the beam of primary electrons moved down a concentration gradient and to die out when the beam moved up a gradient. The frequency of the oscillation was found to agree closely with that calculated from the Langmuir formula, using the plasma electron concentration at the position of appearance of the oscillation. Several checks were applied to the measurements of concentration, including measurements of the positive ion current flowing to a probe and measurements with double probes. (auth)

14496

CHARACTERISTICS OF SHOCK WAVES PRODUCED BY CONDENSED DISCHARGES IN A GAS AT LOW PRESSURE. Michel Cloupeau (Institut du Radium, Paris). J. phys. radium 21, 189-93(1960) Mar. (In French)

The observation of luminous shock waves does not necessarily signify thermal ionization of the gas. It is shown that two other effects may operate in the case of shock waves produced by electrical discharges at low pressures: parasitical discharge effects can cause ionization of the gas ahead of the shock front which then becomes visible, even in the case of low Mach numbers; the shock front and the contact surface are sometimes very close together or, for practical purposes, indistinguishable. The emission of light observed behind the shock front may then be due chiefly to the presence of gas ionized by the electrical discharge. (auth)

14497

CALCULATION OF CERTAIN COEFFICIENTS $<\sigma v>$ INVOLVED IN THE RATE OF THERMONUCLEAR REACTIONS. D. Magnac-Valette, M. Monnier, P. Caffier, and P. Cüer (Laboratoire de Physique Corpusculaire, Strasbourg). J. phys. radium 21, 199-200(1960) Mar.

It is very important that the rates of thermonuclear reactions $<\sigma v>$ should be known. Some discrepancies having appeared between different authors, the calculations of $<\sigma v>$ using recent experimental values of σ were made. Some new values are given also for different conditions of temperature. (auth)

14498

ION-ELECTRON RELAXATION OF PLASMAS IN A MAGNETIC FIELD. [PART] II. Taro Kihara, Yukio Midzuno, Kyoko Sakuma, and Toshio Shizume (Tokyo Univ.). J. Phys. Soc. Japan 15, 684-7(1960) Apr. (In English)

Relaxation between ion and electron temperatures, T_1 and T_2, of dilute fully ionized gases in a magnetic field is treated by a force-correlation method. The rate R of the relaxation, defined by $d(T_2-T_1)/dt = -(T_2-T_1)R$, increases with increasing magnetic field from $R = R^0 \ln (t_p/t_s)$ for $\omega_2 t_p \lesssim 1$ to $R = R^0[\ln (t_p/t_s) + \frac{1}{2}(\ln \omega_2 t_p)^2]$ for $\omega_2 t_p >> 1$, in which $R^0 = (n_1 + n_2)(8m_2/3m_1)(2\pi kT_2/m_2)^{½}(Ze^2/kT_2)^2$. Here m_1, Ze, and n_1 are the mass, charge and number density of the ion, respectively; m_2, $-e$, and n_2 are those of the electron; t_p is the period of plasma oscillation and t_s is the mean time of passage through a sphere of strong interaction, $t_s \sim (m_2/kT_2)^{½} Ze^2/kT_2$; ω_2 is the electron gyration frequency. (auth)

14499

AXIALLY SYMMETRIC STAGNATION-POINT FLOW OF AN ELECTRICALLY CONDUCTING FLUID UNDER TRANSVERSE MAGNETIC FIELD. Tsunehiko Kakutani (Kyoto Univ.). J. Phys. Soc. Japan 15, 688-95(1960) Apr. (In English)

The axially symmetric stagnation-point flow of an incompressible, viscous, and electrically conducting fluid in the presence of a transverse magnetic field with small magnetic Reynolds numbers is considered. The velocity distribution modified by the magnetic field is calculated for several values of N (= SR_m, S: the pressure number, R_m: the magnetic Reynolds number). The shear stress on the wall is expressed in terms of b and $\phi''(0)$, where b is a characteristic parameter of the asymptotic inviscid flow and $\phi''(0)$ is the non-dimensional velocity gradient on the wall. The flow of this type may be considered as a simple model of the circumstance in the neighborhood of the nose of a body of revolution moving through an ionized atmosphere at hypersonic speed. In this context, it may be convenient to use Bush's results for estimating b. The ratio of the shear stresses with and without the magnetic field thus calculated is shown graphically as a function of N. It is found that the shear stress at the wall is considerably reduced by the hydromagnetic interactions. (auth)

14500

STOKES FLOW OF AN ELECTRICALLY CONDUCTING FLUID IN A UNIFORM MAGNETIC FIELD. Kanefusa Gotoh (Kyoto Univ.). J. Phys. Soc. Japan 15, 696-705(1960) Apr. (In English)

The flow of an incompressible, viscous, electrically conducting fluid past an obstacle in a uniform magnetic field is investigated using Stokes' approximation. No particular configuration of the flow and the magnetic field is assumed, so that the result applies to the general three-dimensional problems. It is found that the neutrality of the electric charge density does not hold exactly when the undisturbed magnetic field is not perpendicular to the vorticity vector. It is also found that the vorticity and the electric current density are confined in a paraboloidal region, thus making a "wake" which extends in the direction of the undisturbed magnetic field. Distribution of the electric charge density also shows the same structure. Flow past a sphere is used as an example. The drag is obtained in a power series of the Hartmann number M. The component of the drag perpendicular to the undisturbed magnetic line of force is found to be larger than its parallel component. It is pointed out as an interesting feature of the three-dimensional cases that the velocity field includes components which express the two-dimensional irrotational flow. (auth)

14501

SOME EXPERIMENTS ON PLASMA ALFVÉN WAVES. Shigeo Nagao and Teruyuki Sato (Tôhoku Univ., Sendai). J. Phys. Soc. Japan 15, 735(1960) Apr. (In English)

Transverse hydromagnetic waves (Alfvén waves) were generated in a plasma of ionized air in a linear glass tube with weak magnetic fields, and their phase velocity and attenuation were measured. The velocity and amplitude of the waves are plotted vs. the axial magnetic field, gas pressure, and pre-ionization currents. (D.L.C.)

14502

COHERENT AND INCOHERENT RADIATION FROM A PLASMA. E. G. Harris (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.) and Albert Simon (Oak Ridge National Lab., Tenn.). Phys. Fluids 3, 255-8(1960) Mar.-Apr.

The Vlasov equations have been derived previously by Harris by starting from the Liouville equation and treating both plasma particles and electromagnetic field statistically. A byproduct of this derivation was an equation for $f^{\lambda}(q_{\lambda},p_{\lambda})$, the probability density in the phase space of one of the radiation field oscillators. These functions are now used to define an entropy for the electromagnetic field. If the phases and amplitudes of all electromagnetic waves are precisely defined (coherent radiation), the field entropy is negatively infinite. Any incoherence increases the entropy. A direct consequence of the f^{λ} equation is that the field entropy is a constant of the motion. This is analogous to Newcomb's proof that the particle entropy is constant. It follows that incoherent radiation cannot be calculated from the Vlasov equations. (auth)

14503

ELECTROSTATIC INSTABILITIES OF A UNIFORM NON-MAXWELLIAN PLASMA. Oliver Penrose (Imperial Coll. of Science and Tech., London). Phys. Fluids 3, 258-65 (1960) Mar.-Apr.

A stability criterion is obtained starting from Vlasov's collision-free kinetic equations. Possible instabilities propagating parallel to an arbitrary unit vector e are related to a function $F(u) \equiv \Sigma_j \omega_j^2 \int d^3v\, g_j(v)\, \delta(e \cdot v - u)$, where $g_j(v)$ is the normalized unperturbed distribution function, and $\omega_j \equiv (4\pi n_j e_j^2/m_j)^{1/2}$ the plasma frequency, for the jth type of particle. By using a method related to the Nyquist criterion, it is shown that plasma oscillations growing exponentially with time are possible if and only if F(u) has a minimum at a value $u = \xi$ such that $\int_{-\infty}^{\infty} du(u - \xi)^{-2}[F(u) - F(\xi)] > 0$. A study of the initial-value problem confirms that the plasm is normally stable if no exponentially growing modes exist; but there is an exceptional class of distribution functions (recognizable by means of an extension of the above criterion) for which linearized stability theory breaks down. The method is applied to several examples, of which the most important is a model of a current-carrying plasma with Maxwell distributions at different temperatures for electrons and ions. The meaning of the mathematical assumptions made is carefully discussed. (auth)

14504

STABILITY OF LARGE AMPLITUDE WAVES IN THE ONE-DIMENSIONAL PLASMA. David Montgomery (Princeton Univ., N. J.). Phys. Fluids 3, 274-7(1960) Mar.-Apr.

The problem of the stability of the nonlinear plasma oscillations of Bernstein, Greene, and Kruskal is discussed. The eigenvalue equation for the perturbed distribution function possesses an expansion in powers of a parameter proportional to the maximum value of the equilibrium elec trostatic potential. The stability of any given distribution can be inferred from consideration of the zeroth order alone. (auth)

14505

HYDROMAGNETIC STABILITY OF A STREAMING CYLINDRICAL INCOMPRESSIBLE PLASMA. N. J. Zabusky (California Inst. of Tech., Pasadena). Phys. Fluids 3, 278-88(1960) Mar.-Apr.

A dispersion relation is derived and analyzed for the case where the equilibrium velocity of an incompressible, nonresistive, cylindrical plasma has a spiral motion along magnetic field lines. The symmetric hydromagnetic equations are used to derive the plasma hydromagnetic pressure. The dispersion relation is found by matching plasma and outer-region hydromagnetic pressures across a sharp-moving interface. The zeros of the dispersion relation are obtained by a sequence of mappings between three complex planes. The presence of flow introduces overstable modes. For m = 0 the time-divergences are removed by flow. For m = 1 the divergences are enhanced by flow such that the growth rates and oscillation frequencies increase linearly with the flow velocity. The smaller is the wavelength of the disturbance in the z direction, the larger are the overstable eigenvalues. (auth)

14506

ON THE ELECTRICAL BEHAVIOR OF AN IDEAL PLASMA. Giorgio Gambirasio (Universidade, São Paulo, Brazil). Phys. Fluids 3, 299-302(1960) Mar.-Apr.

The solution of the equation for the current in an ideal plasma, when the electric field, in a direction perpendicular to a constant magnetic field, is abruptly increased from zero to a constant value, is obtained using Laplace transforms. An exact solution and approximate solutions for some simple cases are obtained and discussed. An expression and the corresponding RLC network are found for the specific impedance of the plasma. (auth)

14507

RELATIVISTIC HYDRODYNAMICS FOR A CHARGED NON-VISCOUS FLUID. Chau-chin Wei (National Tsing Hua

Univ., Hsinchu, Taiwan, China). Phys. Fluids 3, 323(1960). Mar.-Apr.

Equations are derived in relativistic hydrodynamics by the application of a variational principle for the behavior of an ideal compressible fluid. The variational method closely resembles that of field dynamics. It is shown that the theorems of circulation and vorticity of classical hydrodynamics can be generalized into relativistic charged ones. (B.O.G.)

14508

RELATIVISTIC CALCULATION FOR CYCLOTRON RADIATION FROM HOT PLASMAS. David B. Beard (Univ. of California, Davis). Phys. Fluids 3, 324(1960) Mar.-Apr.

The equation of motion of an electron in a time-dependent electric field and constant magnetic field is given for the case where insignificant changes in electron energy are neglected. This equation is expanded to give an evaluation for propagation perpendicular to the magnetic field for an oscillator of a given resonant frequency. Equations are given for the refractive index, Maxwell-Boltzmann distribution in energy, and the absorptivity of a plasma. (B.O.G.)

14509

MICROWAVE WHISTLER MODE PROPAGATION IN A DENSE LABORATORY PLASMA. R. M. Gallet, J. M. Richardson, B. Wieder, and G. D. Ward (National Bureau of Standards, Boulder Colo.), and G. N. Harding (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev. Letters 4, 347-9(1960) Apr. 1.

The propagation of a microwave whistler mode near 3000 Mc/sec for $W_H/W \simeq 2$ was observed between cross-polarized short electric dipole antennas over paths up to 24 cm along the ZETA torus axis. Mechanisms of less intense noise bursts are discussed. (C.J.G.)

14510

NONLINEAR PHENOMENA IN PLASMA IN A-C ELECTROMAGNETIC FIELD. V. L. Gienzburg and A. V. Gurevich. Uspekhi Fiz. Nauk 70, 393-428(1960) Mar. (In Russian)

Nonlinear effects appearing in wave propagation in the ionosphere were studied. A supplementary table of plasma field values in the ionosphere and evaluations of the effects of electric fields on the maximum temperature variations in electrons emitted by various energy stations are included. An analysis was made of wave propagation considering nonlinearity (wave interactions), the role of wave interactions in ionosphere cross modulations, and nonlinear non-modulated wave interactions. 133 references. (R.V.J.)

14511

EFFECTS OF PLASMA RESONANCE OF THE ELECTROACOUSTIC WAVE PROPAGATION. V. N. Tsytovich. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron., Fiz. i Khim. No. 2, 135-41(1959). (In Russian)

An analysis was made of the local excitations (for example, at one end of discharge interval) when the wave length exceeds the length of the discharge tube and, thus, corresponds to a heterogeneous perturbation along the tube length. In addition to previous assumptions on the absence of the displacement currents, diffusion, quasineutrality of plasma in equilibrium, Maxwell distribution of velocities, and the mean energy loss of electrons in collision, it is postulated that the oscillations are followed by local changes of electron temperatures and concentrations. This shows that the parameters participating in Maxwell distribution are functions of the coördinate along the tube axis. (R.V.J.)

14512

THE THEORY OF OHMIC HEATING OF COMPLETELY IONIZED PLASMA. H. Schrade, W. Bez, K. H. Höcker, and H. J. Kaeppeler (Technische Hochschule, Stuttgart). Z. Naturforsch. 15a, 155-68(1960) Feb. (In German)

From a solution of the Boltzmann equation by a 13-moment approximation extended to a plasma, the equations for the ohmic heating of a completely ionized plasma were established. The effect of a magnetic field was neglected. As further approximation, the anisotropic fraction of the pressure tensor and the heat current vector in the orthogonal series development for the probability density was neglected so that a local Maxwell distribution resulted. The approximations were established individually. The collision integral, which occurs in the combined equations, was calculated for a Coulomb potential isolated in the Debye radius. A simultaneous system of differential equations is obtained which is suitable for a practical calculation of the ohmic heating in any strong electrical fields. (tr-auth)

14513

ON REFLECTION OF ELECTROMAGNETIC WAVES FROM PLASMA MOVING IN SLOW-WAVE GUIDES. O. G. Zagorodnov, Ya. B. Fainberg, and A. M. Egorov. Zhur. Ekspti'. i Teoret. Fiz. 38, 7-9(1960) Jan. (In Russian)

An experimental investigation of electromagnetic wave reflection from moving plasma was conducted. It is shown that with the wave greatly slowed-down ($^1/_{200}$ to $^1/_{375}$ c) the double Doppler effect observed in reflection increases the frequency by 11 to 20%. The measurements were made at 24.75 MHz. A spiral was used as the damping system. It is indicated that this effect can be utilized for microradiowave amplification, frequency multiplication, improvement of plasma dynamic stability, and measurements in plasma. (auth)

14514

ON CERTAIN PECULIARITIES OF ELECTRON GAS JOULE HEATING IN PLASMA. A. V. Gurevich (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Ekspti'. i Teoret. Fiz. 38, 116-21(1960) Jan. (In Russian)

Electron gas heating in plasma in a constant electric field is considered taking into account non-elastic electron collisions. It is shown that electron temperature can be stable only in weak electric fields with $E < E_k$; at $E \geq E_k$ this state is unstable. Dependence of E_k on plasma ionization was studied. A comparison is made with experimental results. Two modes of heating observed in these experiments are interpreted. Good quantitative agreement with their results is obtained. (auth)

14515

ON THE NON-LINEAR THEORY OF STEADY STATE PROCESSES IN ELECTRON PLASMA. F. M. Nekrasov (Khar'kov State Univ.). Zhur. Ekspti'. i Teoret. Fiz. 38, 233-8(1960) Jan. (In Russian)

Non-linear problems of oscillation modes of electron plasma and interactions of plasma beams are considered on the basis of the kinetic equation without taking into account the collision integral. Relations between the wave length and frequency, and the oscillation amplitude are obtained. The maximum field in which periodic processes in plasma are possible is determined. Conditions for large amplitude wave propagation were found applicable to plasma at rest and plasma of moving beams. (auth)

14516

THE INFLUENCE OF CONDUCTION ANISOTROPY IN MAGNETIC FIELD ON THE SHOCK WAVE STRUCTURE IN

MAGNETOGASDYNAMICS. S. A. Kaplan (L'vov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 252-3(1960) Jan. (In Russian)

The shock front thickness in magnetic plasma and the quantitative effects of conduction anisotropy on the shock structure were evaluated. It is shown that conduction anisotropy induces wave thickness increases which are proportional to the square of magnetic field strength. (R.V.J.)

14517

ISOTHERMAL INTERRUPTIONS IN MAGNETOHYDRODYNAMICS. V. I. Iseplyaev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 255-6(1960) Jan. (In Russian)

At given shock wave parameters all magnitudes vary smoothly. It is shown that a magnetic field creates a more favorable condition for isothermal interruptions. (R.V.J.)

14518

CYCLOTRON ABSORPTION OF ELECTROMAGNETIC WAVES IN PLASMA. K. N. Stepanov (Inst. of Physics and Chemistry, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 265-7(1960) Jan. (In Russian)

The cyclotron absorption of electromagnetic waves is analyzed in relation to microwave diagnostics and high-frequency plasma heating. (R.V.J.)

14519

INVESTIGATION OF A TOROIDAL DISCHARGE IN A STRONG MAGNETIC FIELD. G. G. Dolgov-Savelev, V. S. Mukhovatov, V. S. Strelkov, M. N. Shepelev, and N. A. Yavlinskii. Zhur. Eksptl'. i Teoret. Fiz. 38, 394-403(1960) Feb. (In Russian)

The results of an investigation of a plasma ring in a toroidal chamber with a strong magnetic field are presented. No macroscopic oscillations were observed in the plasma ring under conditions when the Shafranov—Kruskal stability condition was satisfied. Radiation emitted by the plasma in the visible, as well as ultraviolet regions of the spectrum, was studied. It is shown that in a metallic chamber with a limiting pressure of 1 to 2 × 10^{-6} mm Hg most of the radiated energy was caused by impurity ions. (auth)

14520

ON THE MOTION OF A CONDUCTING PISTON IN A MAGNETO-HYDRODYNAMICAL MEDIUM. I. A. Akhiezer and R. V. Polovin. Zhur. Eksptl'. i Teoret. Fiz. 38, 529-33(1960) Feb. (In Russian)

The types of waves excited in a hydromagnetic medium by a uniformly moving conducting plane (piston) are investigated. The question of the resolution of an initial discontinuity is discussed. (auth)

14521

STABILITY OF EQUILIBRIUM OF A CONDUCTING FLUID HEATED FROM BELOW IN A MAGNETIC FIELD. V. S. Sorokin and I. V. Sushkin. Zhur. Eksptl'. i Teoret. Fiz. 38, 612-20(1960) Feb. (In Russian)

The influence of a uniform magnetic field on the stability of equilibrium of a conducting fluid heated from below in a cavity of arbitrary form was investigated. The time variation of the perturbations appearing in the fluid was found to be always monotonous. The critical value of the Rayleigh number C_0^2 above which equilibrium is unstable increased monotonously with the Hartman number M so that inequality (4.16) was observed. For small values of M the critical Rayleigh number was proportional to M^2; this allows the proportionality coefficient to be exactly evaluated. The asymptotic behavior of the function $C_0(M)$ for $M \rightarrow \infty$ was found to depend on the shape of the cavity and the direction of the field. (auth)

Shielding

14522

RADIATION PROTECTION. NEW APPROACH TO MEASUREMENTS NEEDED. Nuclear Eng. 5, 212-13(1960) May.

Effects of the incidence angle on the attenuation of gamma radiation by lead, concrete, and polyethylene barriers were studied using Co^{60}, Cs^{137}, and Au^{198} sources. The data are expressed in terms of ratios of the observed dose rate to that calculated on the basis of normal incidence data for a barrier thickness equal to the oblique path length. The ratios were nearly 1.0 at small oblique angles, but increased with the angle. This effect is greatest for low-energy radiation and thick barriers. (D.L.C.)

Theoretical Physics

14523 AFOSR-TN-59-1125

Hebrew Univ., Jerusalem.

TABLES OF EIGENVALUES AND MATRIXELEMENTS OF TRANSITION PROBABILITIES FOR AN AXIAL SPIN HAMILTONIAN WITH $S = 3/2$. Technical Note No. 9. R. Stahl-Brada and W. Low. July 1959. 58p. Contract AF61(052)-59. (AD-232062).

Numerical eigenvalues of the matrix corresponding to the axial spin Hamiltonian $H_s = g\beta H \cdot S + D(S_z - 1/3)S(S - 1))$ with the spin number $S = 3/2$ are tabulated. These tables are given for various values of θ, the angle between the magnetic field and the crystalline axis in steps of 5 to 85°, and for the dimensionless parameter $x = (g\beta H/4D)$ taking on the values 10, 5, 2, 1, 0.9, 0.8, 0.7, 0.65, 0.6, 0.55, 0.5, 0.45, 0.4, 0.35, 0.3, 0.25, 0.2, 0.15, 0.1, and 0.05. The matrix elements $| < M | J_x | M' > |^2$ and $| < M | J_z | M' > |^2$ are tabulated for the same range of angles and the parameter x. With the help of these matrix elements the transition probability corresponding to transitions $M \rightarrow M'$ can be evaluated. (auth)

14524 AFOSR-TN-60-344

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

ON VAN HOVE'S DIAGONAL SINGULARITY CONDITION. J. Philippot. Mar. 1960. 13p. Contract AF18(600)-1315. (BN-199). OTS.

It is shown that the property called by Van Hove "diagonal singularity" is not represented by a singularity of the δ type in the many-body systems of interacting particles or phonons. On the other hand, this property is verified in certain scattering problems and is then a consequence of the random distribution of the scattering centers. (auth)

14525 LAMS-2328

Los Alamos Scientific Lab., N. Mex.

THEORY OF GRAVITATION, 1920 TO PRESENT: BIBLIOGRAPHY. Ruth H. Lier, comp. Apr. 1959. 155p. Contract W-7405-eng-36. OTS.

A bibliography which is mainly concerned with the theory of relativity, gravitation, gravity, and the unified field theory is presented. The following literature was searched: Nuclear Science Abstracts, Volumes 1 through 12, 1948—58; Physics Abstracts, Volumes 23 through 61, 1920—58; Industrial Arts Index, 1938—58; Chemical Abstracts, Volumes 14 through 50, 1920—56; Technical Information Pilot, 1948—53; Los Alamos Scientific Laboratory Report Library Catalog; and Los Alamos Scientific Laboratory Main Library Catalog. References are given in the form in which they appear in these sources. (auth)

14526 MURA-556
Midwestern Universities Research Assn., Madison, Wis.
ON STURROCK'S PERTURBATION THEORY. W. N. Wong. Jan. 22, 1960. 17p. Contract AT(11-1)-384. OTS.

It was found that Sturrock's perturbation invariants are approximate quantities obtained by truncating the perturbation series expansion of the familiar Poincaré's integral invariants. Application of the second-order invariant so constructed is examined in a simple example. (auth)

14527 UCRL-5694-T
California. Univ., Livermore. Lawrence Radiation Lab.
FUNCTIONAL INTEGRALS AND STATISTICAL PHYSICS. S. G. Brush. Oct. 19, 1959. 39p. Contract W-7405-eng-48. OTS.

Some of the work which has been done in the last few years on the "space time" or "integral-over-all-paths" method in quantum mechanics is discussed. The application of this method to problems in statistical mechanics and its relation to the theory of Brownian motion are considered. (W.D.M.)

14528
SHELL MODEL CALCULATIONS IN THE LEAD REGION WITH A DIFFUSE NUCLEAR POTENTIAL. J. Blomqvist and S. Wahlborn (Nobel Inst. of Physics, Stockholm and Royal Inst. of Tech., Stockholm). Arkiv Fysik 16, 545-66 (1960). (In English)

With the use of a diffuse potential of the Woods-Saxon type, including a spin-orbit interaction, numerical solution of the single nucleon Schroedinger equation is performed with values of the potential parameters appropriate to the lead region. Single particle energies and radial wave functions are obtained for the orbitals in the major shells adjacent to Z = 82 and N = 126, and the changes of the energy eigenvalues with the parameters are estimated. Pairing energy corrections are introduced. The possible occurrence of quadrupole oscillation states is considered, and the corresponding collective corrections to the single particle states are applied. The perturbed energies are compared with the level schemes of the four nuclei, which differ from the double-magic Pb^{208} with one nucleon, and some suggestions and predictions are made. (auth)

14529
MANY BODY PROBLEMS. L. van Hove (Instituut voor Theoretische Fysica, Utrecht). Ned. Tijdschr. Natuurk. 25, 227-39(1959) Aug. (In Dutch)

A review is given of the modern methods used in the study of many body problems. (J.S.R.)

14530
SUPERFLUIDITY AND SUPERCONDUCTIVITY IN ELECTRON GASES. G. Wentzel (Univ. of Chicago). Phys. Rev. Letters 4, 349-51(1960) Apr. 1.

The moment of inertia of Fermion gases is discussed in terms of the "rotating bucket" model of Schafroth. By application of Schafroth's "connection theorem," an analysis of superfluid and superconducting electron gases was made. (C.J.G.)

14531
FINITE SELF-ENERGY OF CLASSICAL POINT PARTICLES. R. Arnowitt (Syracuse Univ., N. Y.); S. Deser (Brandeis Univ., Waltham, Mass.); and C. W. Misner (Princeton Univ., N. J.). Phys. Rev. Letters 4, 375-7 (1960) Apr. 1.

It is shown that finite results for the classical self-energies of point particles can be obtained if the gravitational contribution to the total energy is included, at least for the static (Coulomb-type) contribution. For the static case, it is shown that the natural cut-off furnished by general relativity implies that all the mass of a point charge arises from its total self-field and that a neutral particle has no mass. (C.J.G.)

14532
LIMITATIONS OF TRANSITIONAL RADIATION THEORY. G. M. Garibyan and I. Ya. Pomeranchuk (Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1828-31(1959) Dec. (In Russian)

Polarization properties of media inducing transitional radiation and multiple scattering disturb the ordinary radiation mechanics. It is shown that transitional radiation should be correlated with formulas considering also the medium interface influence on bremsstrahlung and not with the ordinary bremsstrahlung formulas calculated with the assumption of infinite homogeneous media and multiple scattering. (R.V.J.)

14533
TWO-CENTER MODEL AND HYDRODYNAMIC THEORY OF MULTIPLE PARTICLE PRODUCTION. A. A. Emelyanov and L. L. Rosenthal (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Ekstpl'. i Teoret. Fiz. 38, 194-7(1960) Jan. (In Russian)

It is pointed out that with fluctuations of the initial volume or final temperature values, the hydrodynamic theory of collisions of high-energy particles may result in kinematics similar (but not identical) to that predicted by the two-center model. (auth)

14534
S-MATRIX IN THE GENERALIZED QUANTIZATION METHOD. D. V. Volkov. Zhur. Eksptl'. i Teoret. Fiz. 38, 518-23(1960) Feb. (In Russian)

The formalism of the S-matrix for interacting electromagnetic field and half-spin particle field is considered. Particle field quantization is carried out according to a scheme suggested by Green. It is shown that the basic concepts of the conventional theory of S-matrixes (N-product, Wick's theorem, and Feynman graphs) allow a simple generalization within the framework of the quantization scheme considered. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

14535 ANL-6134
Argonne National Lab., Ill.
IBM-704 CODES FOR REACTIVITY STEP CALCULATIONS (RE-126 AND RE-135). C. E. Cohn and B. J. Toppel. Mar. 1960. 30p. Contract W-31-109-eng-38. OTS.

Two codes were written for the IBM-704 to calculate the behavior of a reactor following a step change in reactivity, using one-group, space-independent, zero-power kinetic theory. The reactor is assumed to be running at constant level before the step is made, either at critical or subcritical conditions, with an external source. The code RE-126 assumes all delayed-neutron precursors in equilibrium at the time of the step, while the code RE-135 allows cases with nonequilibrium precursors to be handled. RE-126 can handle the case of zero final reactivity. Both codes are written in FORTRAN language. (C.J.G.)

14536 CEA-1354
France. Commissariat à l'Énergie Atomique, Paris.
FORMULATION GÉNÉRALE ET CALCUL PRATIQUE DU

COEFFICIENT DE DIFFUSION DANS UN RÉSEAU COMPORTANT DES CAVITÉS. (The General Formulation and Practical Calculation of the Diffusion Coefficient in a Lattice Containing Cavities). P. Benoist. 1959. 56p.

The calculation of diffusion coefficients in a lattice necessitates the knowledge of a correct method of weighting the free paths of the different constituents. An unambiguous definition of this weighting method is given here, based on the calculation of leakages from a zone of a reactor. The formulation obtained, which is both simple and general, reduces the calculation of diffusion coefficients to that of collision probabilities in the different media: it reveals in the expression for the radial coefficient the series of the terms of angular correlation (cross terms) recently shown by several authors. This formulation is then used to calculate the practical case of a classical type of lattice composed of a moderator and a fuel element surrounded by an empty space. Analytical and numerical comparison of the expressions obtained with those inferred from the theory of Behrens shows up the importance of several new terms some of which are linked with the transparency of the fuel element. Cross terms up to the second order are evaluated. A practical formula is given. (auth)

14537 DEGR-128(R)
United Kingdom Atomic Energy Authority. Development and Engineering Group. Library and Information Dept., Risley, Lancs, England.
AXIAL STABILITY OF THE NEUTRON FLUX DISTRIBUTION. A. Hitchcock and B. E. Roberts. Feb. 18, 1960. 14p. BIS.

Methods of analyzing the axial stability of the neutron flux distribution under conditions of a substantial positive temperature coefficient are described. It is proposed that stability is encouraged by the use of control rods acting away from the outlet end of the reactor and by a flux distribution which in the steady state is peaked toward the top of the reactor. Curves showing the variation of critical moderator coefficient for stability are given. (C.J.G.)

14538 HW-64340
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PROBLEMS OF A SMALL LEAK BETWEEN THE FLOW MONITOR AND HEATED SECTION OF A PRTR PROCESS TUBE. Galen M. Hesson. Mar. 15, 1960. 9p. Contract AT(45-1)-1350. OTS.

An examination of the effects of small leaks in PRTR process tubes was conducted. Optional procedures of retaining safe operation while avoiding a leak caused flow monitor high flow trip resulting in a reactor scram. (J.R.D.)

14539 KAPL-M-ECH-4
Knolls Atomic Power Lab., Schenectady, N. Y.
AN APPLICATION OF PERTURBATION THEORY TO REACTOR KINETICS—TRANSFER FUNCTIONS FOR A TWO-NODE MODEL. E. C. Hansen. Feb. 26, 1960. 20p. Contract W-31-109-Eng-52. OTS.

Transfer functions of neutron multiplication systems to be used in an analysis of the stability of reactor systems by analogue computers are presented. These are obtained in terms of a two node model, utilizing an n-mode analysis. In addition the so-called higher mode transfer functions are presented. (auth)

14540 NAA-SR-Memo-2177
Atomics International Div., North American Aviation Inc., Canoga Park, Calif.
REFLECTOR CONTROL OF OMR. W. W. Davis. Oct. 2, 1957. 5p. OTS.

The possibility of controlling the organic-moderated reactor through the variation of the liquid level in an annular tank of terphenyl surrounding the core was investigated. The reactivity was measured for such a tank both when full and when empty and the difference extrapolated to an infinite reactor. The maximum reactivity difference was found to be 1.6%, and it is felt that this does not permit enough control to warrant the increase in reactor diameter and the additional construction complexity. (D.L.C.)

14541 NAA-SR-Memo-2648
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMAL NEUTRON SOURCE DISTRIBUTION IN AN OMR UNIT CELL. W. D. Leggett. Apr. 9, 1958. 6p. OTS.

Calculations are made for the thermal neutron source distribution in an organic-moderated reactor using terphenyl as moderator. It is found that weighting the source with resonance escape probability as well as with the volume of moderator decreases the thermal neutron utilization by about 0.5%. (D.L.C.)

14542 NAA-SR-Memo-4980
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
GENERALIZED REACTOR KINETICS CODE AIREK II. A. Schwartz. Feb. 15, 1960. 45p. OTS.

The AIREK code, a one-dimensional reactor kinetics code for the IBM-704 and IBM-709 with a minimum 8K core, is described. It is written in the FORTRAN system and uses no special tapes or drums. It is designed to solve the reactor kinetics equations with respect to time. The maximum number of differential equations that can be solved simultaneously, without any special modification of the code, is 50. Within this framework, there is provision for i delayed neutron groups, $0 < i \leq 25$, and n other linear feedback differential equations, $0 \leq n \leq 49 - i$. (auth)

14543 NP-tr-413
DISTRIBUTION OF NEUTRONS IN THE CENTRAL CELL AND A PERIFERAL CELL OF THE FONTENAY-AUX-ROSE-PILE. F. Roullier. Translated by Robert Gordon (Univ. of Calif. College of Engineering, Berkeley) from report CEA-844. 7p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 9363.

14544
A METHOD OF AVERAGING THE CONSTANTS WITH ALLOWANCE FOR NEUTRON VALUES FOR CALCULATIONS ON A FAST REACTOR. A. I. Novozhilov and S. B. Shikhov. Atomnaya Energ. 8, 209-13(1960) Mar. (In Russian)

A method of averaging multigroup constants for one-group calculations of the critical dimension or critical mass in two-region fast reactors is suggested. The method, used for the solution of a nine-group spatial problem, proved highly accurate and permitted calculations of the critical mass in a two-region reactor without preliminary calculations of the spatial multigroup problem. (R.V.J.)

14545
THERMODYNAMICS OF USING A TURBINE WITH AN ORGANIC LIQUID HEATED IN A POWER REACTOR. P. I. Khristenko. Atomnaya Energ. 8, 214-18(1960) Mar. (In Russian)

Utilization of organic liquids in turbine operation was analyzed. The reactor-heated liquids are evaporated in the turbine jet, and the vapor is superheated with adiabatic expansion. Parameters for the thermodynamic cycle were investigated. (tr-auth)

14546
CHOICE OF THE COOLANT FOR A NUCLEAR REACTOR. E. A. Sidorov. Atomnaya Energ. 8, 252-4(1960) Mar. (In Russian)

Heat transfer factors and coolant pumping power are analyzed for various coolants. (R.V.J.)

14547
BLAST EFFECTS TESTS OF A ONE-QUARTER-SCALE MODEL OF THE AIR FORCE NUCLEAR ENGINEERING TEST REACTOR. Wilfred E. Baker (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 43-8(1959).

The results of a series of nuclear accidents to a one-quarter scale model reactor simulated by explosives and propellants are presented. The accuracy of simulation of these power excursions and the applicability of laws of scaling blast loading and corresponding transient structural response are discussed. (auth)

14548
SOME CHEMICAL PROBLEMS CONCERNING THE HETEROGENEOUS WATER AND ORGANIC MODERATED REACTORS. M. A. Rollier (Università, Cagliari, Italy and SITEN, Milan). Energia nucleare (Milan) 7, 239-48(1960) Apr. (In Italian)

The chemistry of water in a boiling water reactor and the activity levels in the pressurized water systems are discussed. Some chemical and technological problems concerning the boiling water and pressurized water reactors, which have not as yet been solved, are pointed out. Radiolysis and pyrolysis of some organic moderators and coolants and the most recent results obtained in this field are examined. (auth)

14549
AN ANALOGICAL APPROACH TO THE PWR PUMP-FAILURE ACCIDENT. L. Bavesterelli and P. Fornaciari (AGIP Nucleare, Milan). Energia nucleare (Milan) 7, 260-9 (1960) Apr. (In English)

The behavior of the pressurized water reactor during a transient following partial or total circulating-pump failure was studied on the PACE-231 R analog computer of AGIP Nucleare. Some of the results are discussed and plotted. (auth)

14550
CALCULATION METHODS FOR THE CRITICAL SIZE OF A D_2O MODERATED, WET STEAM COOLED REACTOR. PART 2. CONCENTRIC ANNULI FUEL ELEMENT. R. Bonalumi and G. B. Zorzoli (Centro Informazioni Studi Esperienze, Milan) and S. Bruschetti (Ansaldo S.p.A., Genoa). Energia nucleare (Milan) 7, 270-86(1960) Apr. (In English)

An improved neutron calculation for a D_2O reactor with a concentric annuli fuel element is given. A consistent correlation method is also proposed to check theoretical parameters with experimental ones; the neutron calculation is based on a preliminary correlation from Aquilon experimental data. (auth)

14551
IMPROVEMENTS IN OR RELATING TO MECHANISMS FOR CONTROLLING THE OPERATION OF NUCLEAR REACTORS. Donald Mason Sutherland, Harold Proctor, John Kenneth Jobbins, and James Leslie Kearney (to Metropolitan-Vickers Electric Co., Ltd.). British Patent 832,694. Apr. 13, 1960.

A control rod drive mechanism is described which has an eddy current brake with movable magnets. A control rod is raised and lowered by a tape and winding drum mechanism. (T.R.H.)

14552
IMPROVEMENTS IN OR RELATING TO MODERATOR OR REFLECTOR SUBSTANCES FOR NUCLEAR REACTORS. (to Siemens-Schuckertwerke Aktiengesellschaft). British Patent 833,094. Apr. 21, 1960.

A moderator-reflector solution for reactors is described. The solutions used are more dense than the solvents because of solution volume contraction. Specifically Li^7OD or BeF_2 in heavy water or light water is suggested. (T.R.H.)

Power Reactors

14553 ACNP-6001
Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee. PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT [FOR] OCTOBER 1959-DECEMBER 1959. Mar. 15, 1960. 134p. For Northern States Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. OTS.

Technical progress on the research and development program being performed in connection with the design of the Sioux Falls Power Reactor is reported. Areas covered in detail include fuel element research and development, reactor mechanical studies, nuclear analysis, chemistry, instrumentation and control, plant safety analysis, feasibility studies, and steam plant and reactor auxiliary systems design. (For preceding period see ACNP-5924.) (W.D.M.)

14554 AFOSR-TN-59-428
Plasmadyne Corp., Santa Ana, Calif. FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME IV. NUCLEAR FISSION REACTORS. Emil J. Hellund. Apr. 24, 1959. 127p. Project No. 4750. Contract AF49(638)-332. (E-4FR049-332(Vol. IV); AD-214778).

Various methods of adapting nuclear reactor power plants for space vehicle propulsion are considered. Performance of different reactor types and physical limitations on materials are discussed. (W.D.M.)

14555 APAE-62
Alco Products, Inc., Schenectady, N. Y. CONTROL AND DYNAMICS PERFORMANCE OF A SODIUM COOLED REACTOR POWER SYSTEM. [1960]. 29p. Contract AT(11-1)-666. OTS.

In an attempt to prove the feasibility of liquid sodium as a reactor coolant, a design study of three vital system components was undertaken: the intermediate exchanger, the boiler, and the superheater. Investigation shows that, during transient changes in load, the steam and sodium systems' temperature changes will not significantly exceed the small steady-state temperature changes, provided that the control system maintains the design steady-state ratio between the flow rates and power level during the transient. An analog computer study of the controlled system behavior for normal and casualty control is discussed. (W.D.M.)

14556 ATL-A-102
Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif. AN EVALUATION OF MERCURY COOLED BREEDER REACTORS. John O. Bradfute, Donald W. Battles, George S. Clark, Robert E. Corridan, Edward T. Gellenbeck, Devereux L. Kavanagh, Donald R. Mash, Fred E. Romie, and Roger H. Whitlock. Oct. 31, 1959. 289p. Contract AT(04-3)-109, Project Agreement No. 4. OTS.

Under the New Reactor Concepts Evaluation Program sponsored by the United States Atomic Energy Commission, Advanced Technology Laboratories (a Division of American Radiator & Standard Sanitary Corporation) has undertaken an investigation of the technical feasibility and economic potential of the use of boiling mercury as a coolant for fast breeder reactors. The investigation was performed between January 1, 1959, and October 31, 1959. This is the final report on that investigation and is submitted in compliance with the terms of the program authorization, Contract Number AT(04-3)-109, Project Agreement Number 4. (auth)

14557 CF-60-4-4
Oak Ridge National Lab., Tenn.
SUMMARY OF HRT RUN 16. J. R. Engel, P. N. Haubenreich, J. O. Kolb, and D. M. Richardson. Apr. 8, 1960. 68p. Contract [W-7405-eng-26]. OTS.

A detailed account of the Homogeneous Reactor Test Run 16, the first run with uranium in both the core and blanket regions, is presented. Other than mechanical failure of a sampler component and leak development in a fuel feed pump diaphram at the beginning of the run, only minor equipment difficulties were encountered. Evidence of fuel solution instability was obtained. Data obtained in the run showed a dependence of fuel composition and solute inventory on power level. Reactivity disturbances (power pips) were observed at higher powers. (C.J.G.)

14558 CF-60-5-11
Oak Ridge National Lab., Tenn.
NUCLEAR CHARACTERISTICS OF CYLINDRICAL BREEDER REACTORS CONTAINING THORIUM IN PELLET FORM. D. R. Vondy. May 2, 1960. 17p. Contract [W-7405-eng-26]. OTS.

The results of nuclear calculations for aqueous homogeneous reactors containing blanket thorium in pellet form are presented. Critical core fuel concentrations, gross breeding ratios, power densities, and multiplication as dependent on core fuel concentration and neutron balances are included. Critical U^{233} core concentration for a 24-in.-diam. core was 8.4 gm/l when U/Th was 0.003 in the blanket and the relative power density at the core wall was 1.04 kw/l/Mw. A 48-in.-diam. core required 1.6 g U^{233}/l in the core and the relative power density at the core wall was 0.095 kw/l/Mw. The reactors had gross breeding ratios of 1.12 and 1.09, respectively. (auth)

14559 DANATOM-01-60
Danish Assn. for Industrial Development of Atomic Energy, Hellerup.
DESIGN STUDY ON A 175 MW NUCLEAR POWER STATION. Mar. 1960. 137p.

A design study for a 175-Mwe nuclear power plant equipped with a Calder-type gas-cooled reactor is presented. The main design objectives were established, nuclear calculations were performed, and the main design data were determined. Descriptions are given of the general lay-out, reactor, primary and secondary circuits, fuel element handling system, service machine, and auxiliary systems. (W.D.M.)

14560 HPR-4
Norway. Institutt for Atomenergi, Halden.
CALIBRATION OF REACTIVITY EFFECTS AT LOW POWER FOR THE NATURAL URANIUM CHARGE OF HBWR. Heinz Braun. Mar. 1960. 38p.

The most important reactivity effects of the natural uranium charge of the HBWR with the core loading of 124 and 296 fuel elements type A were measured at low power and room temperature. These measured reactivity effects were reactivity of control rods, water level coefficient, and temperature coefficient. From the experiments it was found that for the final core loading, 296, at room temperature: (1) the total reactivity of all control rods at a water height of 240 cm is 9.7%; (2) the water level coefficient of reactivity varies from 88.5 pcm/cm at 165.4 cm D_2O level to 31 pcm/cm at 240 cm D_2O level; (3) the temperature coefficient is -18.1 pcm/°C; and (4) the cold clean excess reactivity at 240 cm D_2O level is 4.1%. (auth)

14561 HW-63768
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PCTR MEASUREMENTS OF THE EGCR LATTICE PARAMETERS. P. F. Nichols, F. C. Engesser, and T. J. Oakes. Mar. 30, 1960. 16p. Contract AT(45-1)-1350. OTS.

Measurements of K_∞, f, p, and ϵ were performed in the PCTR in support of the EGCR Program. The values are listed for the 21.875-in. cell used in the PCTR measurements. (W.L.H.)

14562 KAPL-M-HS-11
Knolls Atomic Power Lab., Schenectady, N. Y.
SUMMARY OF EQUATIONS FOR EFFECT OF SHIP ATTITUDE AND SHIP MOTION ON PRIMARY COOLANT SYSTEM FLOW RATES. H. E. Stevens, Jr. Feb. 16, 1960. 6p. Contract W-31-109-Eng-52. OTS.

14563 MND-C-2201
Martin Co. Nuclear Div., Baltimore.
ANPP CODE DEVELOPMENT PROGRAM, PRESSURIZED WATER TASK. Quarterly Progress Report No. 2 from November 1, 1959 to January 31, 1960. T. M. Olsen, L. Welshans, and C. Eicheldinger. Feb. 1960. 157p. Contract AT(30-1)-2431. OTS.

SYNFAR, the buckling, reflector savings, flux, and reactivity segments of the pilot code, was assembled, checked out, and placed in production status. A reduction of 50% in the computation time required for SYNFAR was achieved through incorporation of a convergence acceleration technique. Modification of SYNFAR to permit computation of dynamic flux and reactivity was made and the option was prepared for checkout. Details of the APWRC Error and Exit Diagnosis package and the APWRC Library Tape System are given. The latter was checked out except for the simultaneous tape shifting function. Digitalization of basic cross section data was completed for fifteen materials. The portion of the Cross Section Data Program which converts the punched card data to magnetic tape form, interpolating as necessary to obtain data at 1001 energy levels, was completed and checked out. The Breit-Wigner Analysis Program, used with the Cross Section Data Program, was checked out. A listing of the Fortran source program, containing definitions of terms used, flow diagrams, input data forms, and a sample calculation is contained. The theory and equations developed to compute the scattering parameters, μ and ξ, also used by the Cross Section Data Program, were developed. Checkout of the corresponding program, XIMU, was started. Theory and equations for computing an inelastic scattering matrix, for use with the Cross Section Data Program, were developed and a FORTRAN program for evaluating them was started. An analysis of the results of the experimental program was started using SYNFAR. Multiplication factors for the two cores studied, Nos. 453 and 454, agreed with the experimental value of 1.00 within 0.6%. The experimental program on Core 454 was completed. Experiments performed were determination of temperature coefficient (-8.9×10^{-5} $\Delta k/k$ per degree centigrade at 35°C), per cent fissions by subcadmium neutrons

(58%), intracell thermal flux measurements, and buckling measurements. Core 453 was assembled. The cold clean critical mass for this core was 17.5 kg of U^{235} with 134.63 grams of natural boron in the core. A complete series of clean core experiments was performed on this core. Core 452 was also assembled. The critical mass for this core was 14.4 kg of U^{235} with 83.14 grams of natural boron in the core. The critical experiment control rods were calibrated. Material and dimensional specifications of the homogeneous fuel elements were prepared. A number of sample blocks containing powdered stainless steel and lucite was pressed. Improvements in the process are being made in an attempt to minimize dimensional variations from block to block. (See also MND-E-2119.) (auth)

14564 NAA-SR-4047

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OMRE FUEL PLATE SURFACE TEMPERATURE MEASUREMENT. S. Sudar. May 1, 1960. 38p. Contract AT-11-1-GEN-8. OTS.

The surface temperatures of OMRE fuel-elements were measured with chromel-alumel thermocouple assemblies attached to the fuel plate surface. Surface temperature measurements were found to be subject to error as a result of a disturbance to the temperature field produced by the temperature measuring assembly due, in part, to the transfer of heat from this assembly to the coolant. Experimental determinations were made of the extent of perturbation of the true surface temperature. At OMRE operating conditions of 750°F true fuel-plate surface temperature and 600°F bulk coolant temperature, the observed surface temperature was lower than the true surface temperature by 30% of the difference between the true surface and the bulk coolant temperatures, a temperature depression of 45°F. At reactor operating conditions of 750°F true fuel-plate surface temperature and 500°F bulk coolant temperature, the observed surface temperature was lower than the true temperature by 35% of the true surface-bulk coolant temperature difference, a temperature depression of 88°F. Factors for correction of observed OMRE surface temperature are presented. (auth)

14565 NAA-SR-4812

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PLUTONIUM-ENRICHED OMR CORES. T. J. Connolly. May 1, 1960. 45p. Contract AT-11-1-GEN-8. OTS.

The influence of Pu on the nuclear characteristics of organic moderated cores is studied. Three modes of loading Pu are considered: Pu enrichment of U fuel, separate Pu and U fuel elements uniformly distributed in the core, and separate Pu and U fuel elements grouped in separate core zones. In each case, the effect of variations in Pu and U^{235} concentrations is studied. The characteristics calculated include: infinite multiplication, conversion ratio, intracell power distribution, and the rate of decline of multiplication with burnup. Plutonium-enriched cores generally exhibit a slower rate of decline of reactivity with burnup. Segregation of Pu and U results in higher multiplication for a given average fuel concentration. The mixed Pu-U fuel results in a better neutron economy and a higher conversion ratio. Segregated fuel, in general, has a higher fuel power density but a lower volumetric power density. No particular advantage to grouping the Pu and U elements in separate zones was observed. (auth)

14566 NAA-SR-4886

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OMR DEGASIFIER LOOP EXPERIMENT. G. W. Corporales and P. R. Benson. May 1, 1960. 44p. Contract AT(11-1)-GEN-8. OTS.

A loop was constructed to study the removal of water and highly volatile materials from Organic Moderated Reactor coolant by vacuum degasification. An analysis of the process was made to determine the effects of pressure, feed rate, nozzle pressure drop, and temperature upon degasification efficiency. The rate of degasification was quite sensitive to pressure. The other parameters had only minor effects. Experimental results showing the effects of various parameters on the rate of degasification of nitrogen from monoisopropyl diphenyl and from Santowax R are given. (auth)

14567 NAA-SR-Memo-4461

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

FURTHER NUCLEAR CALCULATIONS ON THE 255 MWE ADVANCED SGR. A. L. Aronson. Oct. 10, 1959. 26p. OTS.

Calculations are carried out on the 255-Mwe advanced sodium graphite reactor (ASGR), calandria core type, and the following functions are plotted: (1) k_{eff} and initial conversion ratio vs. enrichment from 2.0 to 4.0 at. % U^{235} at 1250°C as moderator temperature; (2) radial and axial neutron flux distribution vs. distance from core; and (3) k_{eff} and moderator coefficient of reactivity vs. moderator temperature. For (2) and (3), the enrichment was 2.5 at. % U^{235}; the neutron balance for (2) is tabulated. The k_{eff} is compared with that for the 250°F isothermal clean (i.e., no Xe or Sm) case, and the 350°F case is found to possess an initial excess reactivity of 3.25%. The moderator temperature coefficient is found to decrease with temperature and to become negative above 1000°C. Reflector savings, which were found to be large, especially for the radial reflector, are plotted vs. neutron temperature. The analysis is done with a two-group, two-region criticality scheme. The reactor is described in detail and its characteristics, e.g., microscopic neutron cross sections for individual reactor materials, are given. (D.L.C.)

14568 NAA-SR-Memo-4671

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PERFORMANCE REQUIREMENTS AND DYNAMIC RESPONSE OF PIQUA OMR REACTOR OUTLET TEMPERATURE CONTROL SUBSYSTEM. R. L. Detterman. Nov. 23, 1959. 65p. OTS.

A constant outlet temperature cascade control system is designed for the Piqua OMR reactor and is found to hold outlet temperature constant to within ± 2°F with a power change of 20% per minute and within ±1°F with 4% per minute change. The control system uses 13 magnetic jacks and associated control rods. The center rod has a peak reactivity of 4.6×10^{-5} Δk/sec, more than adequate for dealing with xenon transients or plant load changes. All the factors influencing operation, e.g., rod position controllers, nonlinear oscillations, are discussed. An analog model of the magnetic jack was set up successfully and a summary of analog runs with various disturbances is given. Manual change of the controller gain with flow change is suggested in preference to automatic change. Possible modifications of the control system are discussed. (D.L.C.)

14569 NAA-SR-Memo-4914

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RADIAL TEMPERATURE PROFILE OF SODIUM POOL BOILING HEATER ASSEMBLY. H. H. Cappel. Feb. 22, 1960. 8p. OTS.

The radial temperature around a sodium reactor heater assembly submerged in water is calculated using a model of the heater cross section found by conformal mapping. Thermocouple readings were also analyzed. When the heat flux is 5×10^5 Btu/hr-ft^2, a radial temperature drop of about 680°C across the center of the thermocouple well is calculated and found to be within 6% of the experimental value. Since most of this drop is across the 0.001-in. helium gap between the heater and its sleeve, it is concluded that the thermocouple will have to be bonded to the sleeve for dependable reading of true sleeve temperature. Drawings of the heater assembly and thermocouple are given. (D.L.C.)

14570 NDA-2114-2
Nuclear Development Corp. of America, White Plains, N. Y.
FURTHER EXAMINATION OF SEAWOLF (S2G) COMPONENTS. Jan. 31, 1960. 40p. Contract AT(11-1)-732. OTS.

The components examined were the electromagnetic pump, two-inch shut-off valve, and eight-inch check valve. In the electromagnetic pump, examination was made of the 8-in. bellows, transition section, and pump cell for evidence of erosion, corrosion, leaks, cracks, or unusual deposits. In the shut-off valve, examination was made of the plug and seat for hardness. Analysis was made for composition and structure if any unusual effects were indicated in hardness tests. In the check valve, examination was made of the journal to determine the origin of the pitting and black deposit observed on its surface. (W.D.M.)

14571 NDA-2132-3
Nuclear Development Corp. of America, White Plains, N. Y.
A STUDY OF WET STEAM AS A REACTOR COOLANT. Quaterly Technical Progress Report for the Period January 1, 1960 through March 31, 1960. Apr. 29, 1960. 27p. Project No. VII. Contract AT(30-1)-2303. OTS.

Test specifications for studying heat transfer, corrosion and erosion, and water injection in the application of wet steam cooling to light-water-moderated reactors are suggested. To evaluate the feasibility of operating a fog-cooled reactor beyond the burnout point, the cladding beyond burnout was calculated for temperature drop of 250 to 550°F between surface and bulk of coolant. The effect of the diameter of the central reflector on the maximum-to-average radial thermal flux and on reactivity was calculated. Derivation of the burnout correlation based on the model which assumes droplet diffusion to a wall is given. Formulas for calculating thermal cross section, thermal regeneration factor, resonance escape probability, fast fission factor, and L^2 and τ were derived. (C.J.G.)

14572 NP-8549
[Consolidated Edison Co. of New York, Inc.].
HAZARDS ANALYSIS AND DESIGN FOR CONTAINMENT VESSEL—CONSOLIDATED EDISON REACTOR. Aug. 29, 1958. 112p. OTS.

The basis for design of the containment vessel for the Consolidated Edison nuclear power plant is outlined, and data to support the design presented are provided. Topics covered include maximum credible incident, pressure buildup within the containment vessel, metal—water reaction, missile protection, mechanical design, arrangement inside containment vessel, ventilation and spray cooling, radiation shielding, vessel leakage analysis, and testing. (W.D.M.)

14573 ORNL-2157(Pts. 1-5)(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1956. Dec. 13, 1956. Decl. with deletions Oct. 28, 1959. 265p. Contract W-7405-eng-26. OTS.

Aircraft Reactor Engineering. Most of the detail drawings of the reactor-core, heat exchanger, pump, and pressure-shell assembly for the ART have been completed, and design work on the reactor shield and the interior of the reactor cell is proceeding. Tests of a fuel pump in a high-temperature test rig have indicated that the cavitation limit is somewhat lower than anticipated. The preliminary design of the fuel-recovery tank was completed. Studies of the reactor support structure were completed. A series of low-frequency thermal-cycling tests of the core shells is under way. Additional core flow studies were made on the full-scale model of the ART core. The results of experiments performed to determine the rate of gamma heating in various target materials near the BSF reactor were compared with results calculated by methods used for determining similar ART gamma heating rates. The ART simulator was used for a study of temperature control of the reflector-moderator and the temperature responses of the reflector-moderator cooling system. Tests were continued on a helium-bubbler type of level indicator for the fuel expansion tank. Evaluation tests of several types of high-temperature pressure-transmitters were continued. Evaluation studies of lubricating and cooling fluids for pumps were continued. Development test work on the fuel pump impeller continued. Liquid-metal-vapor condensers are being developed for use in helium purge systems in the ART sodium and NaK circuits and the NaK dump tanks. Chemistry. Phase equilibrium studies of fuel system components were continued. Studies of the $RbF-UF_4$ system progressed sufficiently for a tentative equilibrium diagram to be prepared. In studies of the $RbF-CaF_2$ system it has not been possible to get reproducible data for compositions containing more than 15 mole % CaF_2. A study of the $CsF-BeF_2$ system was started in order to complete the study of the alkali fluoride—beryllium fluoride systems. Investigation of the equilibrium reduction of NiF_2 by H_2 in $Naf-ZrF_4$ was continued. The study of the activity of Cr in Cr—Ni alloys was completed, and the values obtained at 750 and 965°C are presented. Studies of the reduction of UF_4 by structural metals were extended to include the reaction media $RbF-ZrF_4$ and $LiF-BeF_2$. The solubilities of the structural metal fluorides NiF_2, FeF_2, and CrF_2 in molten $NaF-ZrF_4$ that were determined by using concentration cells and an emf method are presented. A systematic investigation of the solubilities of rare-earth fluorides in ART-type fuels was initiated. Density determinations were made on $NaF-ZrF_4$ at 600, 700, and 800°C. The diffusion of uranium fluoride-containing mixtures into graphite was studied. A device was constructed which will permit visual observation of compatibility tests of molten fluoride salts and alkali metals with pump lubricants. Metallurgy. Two Inconel forced-circulation loops were operated with the fuel mixture $NaF-ZrF_4-UF_4$ at maximum fuel temperatures of about 1500 and 1650°F in order to compare the corrosion properties. Examination of a Hastelloy B forced-circulation loop that operated with $NaF-KF-LiF-UF_4$ verified the excellent corrosion resistance of Hastelloy B to fluoride mixtures as observed previously in thermal-convection loops. Data obtained in cyclic strain tests of Inconel in a He atmosphere are presented. Corrosion tests on resistance-welded Inconel and on brazing alloys are presented. The intermetallic compounds NiAl, NiAl + 5% Ni, NiAl + 4% Zr, and MoAl were corrosion tested in static Na and in $NaF-ZrF_4-UF_4$ for 100 hr at 1500°F. Work on the development of Ni–Mo base alloys was continued. The preparation of tubing of the ternary alloys based on Ni–17% Mo alloys with additions of Ti, Al, W, Nb, Cr, Fe, V, or C was continued. Encouraging results were obtained in the fabrication of tubular control rods by co-extrusion. A study of the fabrication and physical properties of europium oxide was initiated. Heat Transfer and Physical Properties, Radiation Damage, Fuel Recovery and Reprocessing, Critical Experiments. The fluid friction characteristics of 60-deg staggered spacers and 60-deg inclined spacers placed alternately in a model of the ART fuel-to-NaK heat exchanger were determined. Heat transfer experiments were conducted on the ART core model with a vaned entrance system under uniform volume heat source conditions. The enthalpies and heat capacities of a zirconium-base fuel with additives to simulate fission products were determined. A series of charcoal traps of different geometries but with the same amount of charcoal are being tested in radiokrypton holdup experiments. The fused salt-fluoride volatility pilot plant is essentially complete and shakedown tests have started. The decomposition of the complex $UF_6 \cdot 3NaF$ to a nonvolatile product was studied over the temperature range 245 to 355°C. Reactor Shielding. The results of calculations of gamma-ray energy flux, dose rate, and buildup factors in a lead–water shield of finite thickness are presented. The gamma-ray energy spectrum and time decay characteristics of the fission products of U^{235} related to circulating-fuel reactors are being investigated. Experiments are under way in an investigation of the effect on the dose rate outside the ART lead shield of gamma-ray streaming through the NaK filled pipes. Nuclear calculations were made in order to provide information for detailed design of the reactor core-reflector-island region of the Shield Mockup Core (SMC). (W.L.H.)

14574 ORNL-2440(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING DECEMBER 31, 1957. Apr. 24, 1958. Decl. with deletions Nov. 4, 1959. 222p. Contract W-7405-eng-26. OTS.

Aircraft Reactor Engineering. A summary of the status of the ART-ETU program at the time it was cancelled is presented. Operation of the fuel pump endurance test was resumed. Operation of the primary NaK pump loop No. 1 at elevated temperatures was resumed in order to observe the effects of the lower seal area of operating without a purge flow down the shaft annulus. The Inconel thermal barrier that was designed to protect the bearing-housing region of the ART sodium pumps from thermal and radiation damage was subjected to tests. The test of the ART control rod drive system was terminated after successful operation. Performance of the fuel-expansion-tank continuous level indicator is presented. A resistance-type fuel level indicator was designed. Operation of a 1-inch turbine flowmeter installed in a forced-circulation gas-fired Inconel loop containing a fused salt fuel is described. Additional tests were made of strain-gage pressure transmitters designed for use at high temperatures. Results of tests on sheathed and well thermocouples are given. A summary of the quantities and types of materials and components inspected is given. Results of high-frequency thermal-cycling tests of Inconel pipes are presented. Forced convection heat transfer studies with KCl–LiCl flowing in a heated tube were continued. Results are given of an investigation of burnout heat fluxes for water in nucleate boiling. A comparison of heat transfer data is given for vortex flow and straight-through linear flow. Final results were obtained for the enthalpies and heat capacities of the eutectic mixtures $LiCl-SrCl_2$ and $LiCl-BaCl_2$. Chemistry. A comparison of Russian and ORNL investigations of the $NaF-ThF_4$ system is given. An apparatus for high-temperature thermal-gradient quenching experiments is described. The preparation of UF_3 and its stability in molten fluoride mixture is described. Activity coefficients of FeF_2 and NiF_2 in molten $Naf-ZrF_4$ are given. The reduction of Fe, Mo, Nb, Ta, V, and W in molten fluorides is described. Data are given on the solubilities of noble gases in molten fluoride mixtures. The solubility of Hf and fission products in $NaF-ZrF_4$ mixtures is given. Determination of Cr diffusion coefficients in Inconel–molten salt system is presented. Data are given on steady-state Cr migration in thermal-convection loops. Results of the dissolution of Type 347 stainless steel in NaF–KF–LiF eutectic by hydrofluorination are given. Metallurgy. Development work on Ni–Mo base alloys for use as reactor structural materials in contact with fused salt fuels was terminated. Mechanical properties and corrosion resistance of Ni–Mo alloys are given. Creep and stress-rupture data were obtained for Inconel in Ar, Na, and fused salts. Fabrication of thermocouples for high-temperature service is described. An investigation of optimum welding methods for fabricating the fill-and-drain tank tube-to-tube sheet joints was completed. Radiation Damage. Examination of the four forced-circulation loops that were operated in the MTR with fused fluoride fuels as the circulated fluids was completed. Examinations were continued of the moderator materials that were irradiated in the second exposure in the MTR. The out-of-pile tests that correspond to the MTR tube-burst tests were completed. In an investigation of irradiation effects in photoconductive detectors, both neutrons and gamma irradiation were found to decrease the photoresponse of PbS cells, and the decrease is proportional to the total integrated flux. A state-of-the-art survey of irradiation effects in semi-conductor barriers is presented to unify the material presented in previous progress reports and to establish a reference of current concepts. (W.L.H.)

14575 TID-5743
American Electric Power Service Corp., New York.
ECNG–FWCNG GAS-COOLED REACTOR PROJECT; MINUTES OF PROGRESS REVIEW MEETING, JANUARY 14, 1960. R. B. Finn, Jr. Feb. 17, 1960. 16p. OTS.

Physics analyses of various accidents or cases of misoperation are in progress. Constant revision of the prototype plant reference design has changed the nuclear characteristics of the plant to the extent that it was necessary to revise the physics calculations to reflect the latest design. It appears that the required enrichment will be approximately 1.8%. A reference design of the core for the 300 megawatt-electrical plant was established, and preliminary calculations are under way to determine fuel burnup attainable with this design using natural uranium. (auth)

14576 UCRL-5465(Rev. Summary)
California. Univ., Livermore. Lawrence Radiation Lab.
TORY II—A REACTOR CONTROL SYSTEM DEVELOPMENTS. Robert E. Finnigan. Mar. 12, 1960. 45p. Contract W-7405-eng-48. OTS.

Tory II-A, the first experimental reactor in the Pluto nuclear ramjet program, will be tested in late 1960 at the Nevada Test Site of the Atomic Energy Commission. The fundamental objective of Tory II-A is to demonstrate that a high power-density, high-temperature, air-cooled reactor can be successfully designed, constructed, and operated. This application places requirements on the reactor control system which are considerably more stringent than those found in previous reactor systems, both from the standpoint of radiation environment and system performance. To fulfill the system requirements a high-performance reactor control system has been designed and built; control actuation hardware has been developed which can withstand the high-radiation environment of Tory II-A. This actuation system features radiation-tolerant electrohydraulic components: actuators, servo-valves, solenoid valves, feedback transducers, accumulators and associated hydraulic components. To provide high reliability against undesired shutdowns while carrying out high power level transients, the Tory II-A control philosophy includes a new concept in reactor safety: reliance on a nonlocking, fast-reset safety system during accident situations. The fast-reset system acts so as to hold the programmed power level rather than initiating an irreversible "scram" action. A reactor "scram," if tolerated, could produce thermal shocks which would seriously damage the core components. (auth)

14577 YAEC-169
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE PERIOD JULY 1 TO SEPTEMBER 30, 1959. H. E. Walchli. Nov. 15, 1959. 63p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

The prototype fuel assembly using depleted UO_2 was completed and inspected. The assembly indicated acceptability of proposed techniques and tolerances. The control rod program was completed and analysis performed which neglected effects of non-uniform depletion and poison buildup. A program applicable to the first 500 hours of operation was prepared. The analysis of two-region critical experiments was completed. It was determined that uncracked fuel assembly brazes were not weakened when subjected to borated water with or without lithium addition for pH adjustment. Galvanic cell studies on Ag-In-Cd control rod materials revealed that thin, heat-treated nickel platings protect the base alloy against internal oxidation in high temperature water, and that these platings are resistant to gross corrosive attack. The magnetic jack positive latch control rod drive mechanism completed more than 1,000,000 operating cycles. (For preceding period see YAEC-161.) (auth)

14578
CIRCULATION CALCULATIONS FOR A BOILING WATER REACTOR. [PART] III. W. Balz and R. Schwarzwälder (AEG-Kernenergieanlagen, Frankfurt am Main). Atomkernenergie 5, 86-91(1960) Mar. (In German)

In this last of three papers the circulation calculation proper is treated. The circulation scheme of a boiling water reactor is considered first; the method of calculation is described and explained. In conclusion, the results of a circulation calculation are given and discussed with the help of diagrams. (auth)

14579
AMERICAN WORK ON PEBBLE-BED REACTOR PROJECTS. W. Klieforth. Atomkernenergie 5, 92-9(1960) Mar. (In German)

A survey is made of the American developments on pebble-bed reactors, beginning with the first proposals. Data for the Power Breeder Reactor, the BBC-Krupp Reactor, and the Flowing-bed Reactor are tabulated. 7 references. (J.S.R.)

14580
SAFETY CONTAINMENT OF POWER REACTORS. [PART] II. Thomas Jaeger. Atomkernenergie 5, 100-7(1960) Mar. (In German)

The general principles in the design of pressure vessels for reactors are reviewed. Examples of pressure vessels for the Argonne Boiling Reactor and the Dresden Power Plant are given. Safety and engineering aspects of the enclosure of power reactors in rock caverns are discussed. 33 references. (J.S.R.)

14581
PREDICTIONS ON THE COST-PRICE OF NUCLEAR ENERGY. A. A. de Boer. Atoomenergie 2, 58-61(1960) Apr. (In Dutch)

The predictions made in 1957 on the cost-price of nuclear energy are re-examined to determine how accurate these suppositions were. It is concluded that the predictions were in error, but not greatly. The decline in the coal price is the reason for the difference in favor of the cost-price of classical energy. (tr-auth)

14582
NUCLEAR ENERGY PRODUCTION. E. Busse (Deutsche Atomforum, Düsseldorf). Brennstoff-Wärme-Kraft 12, 134-6(1960) Apr. (In German)

A brief review is given of world progress in nuclear power production. (T.R.H.)

14583
HEAVY-WATER REACTORS FOR POWER PRODUCTION. David P. Herron (American Standard, Mountain View, Calif.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 49-56(1959).

The near-term costs projected for heavy-water nuclear plants, fuel fabrication, and charges for heavy-water losses and inventory is shown to result in total power costs from heavy-water reactors (and other reactor types) in the range of 12 mills/kw-hr. The principal factors affecting the fuel-cycle and capital in design of heavy-water reactors are reviewed, and several possibilities for reducing the power cost of this type of reactor are discussed. (auth)

14584
BOILING-HEAVY-WATER REACTOR FOR PROCESS STEAM AND POWER. Patrick J. Selak and George B. Humphreys (Henry J. Kaiser Co., Oakland, Calif.). Chem. Eng. Progr. 55, Symposium Ser. No. 27, 83-9(1959).

A 200 Mwh boiling-heavy-water reactor fueled with a natural-uranium alloy in the form of flat-plate elements clad with an aluminum-nickel alloy is described. This plant produces 175,000 lb/hr of light-water process steam at a pressure of 115 psia and a net electrical output of 30 Mw. The net fuel cycle cost is 21¢/10^6 Btu. The total cost of process steam produced in this reactor is 88¢/10^6 Btu, and the cost of the electricity produced is 14 mills/kw-hr. For a hypothetical reactor plant located in the United States there is no significant difference in the net fuel cycle cost or the cost of steam produced, whether the reactor is operated with fuel element reprocessing or on a throw-away basis, suggesting the suitability of this reactor for remote mining and processing operations. (auth)

14585
CAPITAL COSTS OF A NUCLEAR POWER PLANT.

J. Anten. Econ.-statist. Ber. 44, 806-8(1959). (In Dutch)

The reduction of costs of a nuclear power plant by: lower costs at equal production, equal costs but higher production, and the construction of plants with a considerably larger capacity is discussed. (Reactor Centrum Nederland)

14586

DEVELOPMENT OF HEAVY-WATER POWER REACTORS IN CANADA. F. W. Gilbert. J. Atomic Energy Soc. Japan 2, 153-7(1960) Mar. (In Japanese)

14587

SOME HIGHLIGHTS OF EXPERIENCE AND ENGINEERING OF HIGH-POWER, HEAVY-WATER MODERATED NUCLEAR POWER REACTORS. W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Brit. Nuclear Energy Conf. 5, 30-6(1960) Jan.

Canadian high power heavy-water-moderated reactors are discussed. The design and the experience gained in their operation since 1951 are given. Among the topics discussed are fuel and cladding ruptures, reactor control, and xenon poisoning, and cost. (D.L.C.)

14588

A GAMMA RAY IN Ti^{45} DECAY. Chikai Ishii and Kasuke Takahashi (Tôhoku Univ., Sendai). J. Phys. Soc. Japan 15, 736-7(1960) Apr. (In English)

An investigation of the Ti^{45} decay was carried out for any gamma rays emitted, since such emission would indicate positron branching of the low-lying excited states of Sc^{45}. Titanium was irradiated with bremsstrahlung and the resulting gamma rays were studied; in addition to known gamma rays from nuclides produced by photoreaction with Ti isotopes, a weak 0.38 Mev gamma ray with a half life of ~3 hr was detected and assigned to the transition from the first excited state of Sc^{45} at 0.377 Mev. A very weak gamma ray at 0.541 Mev is thought to exist, but of a relative intensity less than 0.1%. A decay scheme for Ti^{45} is proposed. (D.L.C.)

14589

METHODS OF INCREASING THE EFFICIENCY OF NUCLEAR POWER STATIONS WITH GAS-COOLED REACTORS. T. Ch. Margulova and L. S. Sterman (Moscow Inst. of Power Engineering). Jaderná energie 6, 74-9 (1960). (In Czech.)

The main factors influencing the efficiency of nuclear power stations with gas-cooled reactors are analyzed. On the basis of research results gained on the Chair of Nuclear Power Stations at the Moscow Power Institute, the possibility is indicated of creating better conditions in a nuclear power station for optimal thermal efficiency even with present equipment and working media. (auth)

14590

R3/ADAM, COMBINED HEATING AND POWER PROJECT. Nuclear Eng. 5, 202-5(1960) May.

The R3/Adam Power and Heat Station, sited at Agesta, Sweden, and scheduled to go into operation in 1963, is discussed. It incorporates a heavy water power reactor designed for simultaneous generation of 10 Mwe and 55 Mwh, the latter being in the form of hot water for domestic heating. The details and dimensions of the reactor and drawings of the fuel element bundles are given; the coolant circuit is also described. (D.L.C.)

14591

THE INSTABILITY PROBLEM IN GAS-COOLED REACTORS. A. Fonda (Central Electricity Generating Board, London). Nuclear Power 5, No. 49, 93-6(1960) May.

Investigations of the controlled reactor system in the CEGB reactor shows that there is a third source of instability as well as the two sources intrinsic to the uncontrolled reactor. This instability arises through the choice of inappropriate control parameters and results in the control system forcing the system as a whole into a divergent response. The time constant of this kind of instability depends on the choice of control system parameters and can be as low as a few minutes. Fortunately there are fairly wide ranges of parameter values which give a stable response. (auth)

14592

SMALL POWER REACTOR SURVEY. J. Spencer Burkett. Nuclear Power 5, No. 49, 97-100(1960) May.

The demand for small nuclear power plants is likely to be centered in comparatively under-developed regions where difficult access to fuel and absence of a national grid limits human activity and prevents industrial potential from being developed. Reactors for these areas will have to be reliable and simple to operate because expert assistance will not normally be available. In such cases, where power is urgently required for mining, distillation of brackish water, irrigation pumping, metallurgical and isolated industrial plant, the need is sufficiently great to dictate the use of nuclear power generation even though the cost of power would be high by American or European standards. Even in the USA, the Rural Electrification Administration has shown a strong interest in such small reactors for outlying communities in high power cost areas. A review of such power plants in USA, United Kingdom, and other countries is presented. (auth)

14593

General Nuclear Engineering Corp., Dunedin, Fla. POWER REACTOR TECHNOLOGY. Technical Progress Review, Vol. 3, No. 2. Walter H. Zinn, ed. 1960. 76p. $0.55(GPO)(domestic), $0.70(GPO)(foreign).

General Research and Development. Section one of this volume is devoted to evaluation of large and small power reactors. The second section discusses applications to nuclear ship propulsion. In the third section the cost and supplies of enriched uranium are reported. The fourth section discusses the significance of breeding, fast breeders, and thermal breeders. The fifth section is devoted to reactor physics and discusses heavy-water lattices, measurement of Doppler coefficient, and thermal neutron flux distributions in fuel specimens. Heat transfer and fluid flow are discussed in the sixth section. The seventh section is devoted to shielding and discusses the neutron distribution in the reactor shield, interactions of fast neutrons in Fe, Pb, O_2, and N_2, and gamma-ray attenuation and heating codes. The last section on materials reports on the fabrication of UO_2 fuel elements, thermal conductivity of UO_2 fuel elements, steam corrosion data for UO_2, and oxidation of UO_2 in CO_2. Progress on Specific Reactor Types. The four sections comprising this part of the volume are devoted to heavy-water reactors, Sodium Graphite Reactor, molten plutonium reactors, and organic-cooled reactors. (W.L.H.)

14594

PEBBLE BED NUCLEAR REACTORS FOR SPACE VEHICLE PROPULSION. M. M. Levoy and J. J. Newgard (Thiokol Chemical Corp., Denville, N. J.). IAS Paper No. 60-39. Presented at the IAS 28th Annual Meeting, New York, New York, January 25-27, 1960. New York, Institute of the Aeronautical Sciences, 1960. 18p. $1.00.

The design considerations and limitations are given for a proposed pebble-bed nuclear reactor for use in space vehicle propulsion. The fuel pellets are uranium-impregnated graphite of 0.7 to 3 inches diameter. The thrust is 9000 lb for a vehicle gross weight of 33,300 lb. Curves are given which indicate reactor characteristics. (B.O.G.)

14595
IMPROVEMENTS IN POWER PLANT FOR NUCLEAR REACTORS. (to Babcock & Wilcox Ltd.). British Patent 832,877. Apr. 13, 1960.

A power system design is offered for use with reactors. This system provides for reheating the steam between pressure stages. Reheat exchangers, economizer, reheaters, and a very low pressure system and their arrangement are described. (T.R.H.)

14596
FLUID COOLED NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). British Patent 833,623. Apr. 27, 1960.

A reactor is described which is adapted to removal of irradiated fuel without a cooling-off period. The horizontal fuel channels through the moderator block open at the discharge end into a water-filled chute. Thus, the elements are continuously cooled during discharge and storage. A loading mechanism is also described. (T.R.H.)

14597
IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Peter Fortescue (to United Kingdom Atomic Energy Authority). British Patent 833,647. Apr. 27, 1960.

A high-temperature power reactor and fuel element are described. The fuel is placed loosely in a tubular moderating container with a vent. Damage and distortion of the fuel thus does not affect operation of the reactor. Heat radiates from fuel to container and is conducted to the coolant. These elements are placed in the reactor in 7-element assemblies with coolant channels provided. The graphite moderator in the tubular container has a helical slot for the fuel strip. (T.R.H.)

Production Reactors

14598 HW-64310
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
REAMED REAR FACE PARKER FITTING. P. B. McCarthy. Mar. 17, 1960. 12p. Contract AT(45-1)-1350. OTS.

A study and tests of the feasibility and best method of reaming rear face Parker fittings of Hanford Production Reactors were made. Flow increase of 8%, based on maintaining the same front header pressure, can be obtained at B, D, and F reactors by reaming the rear Parker fittings to 0.610-in. and using existing rear face hardware. Tests indicate mechanical strength will not be significantly reduced, high-frequency vibration will not be increased, and methods of reaming are available. (W.L.H.)

Research Reactors

14599 CF-60-4-31
Oak Ridge National Lab., Tenn.
STUDIES OF IMPROVEMENT OF POWER DENSITY IN ORR LOOPS. M. L. Tobias and D. R. Vondy. Apr. 11, 1960. 11p. Contract [W-7405-eng-26]. OTS.

Using a simplified model, calculations were made of the possible effects of voids upon the power density in ORR loop experiments. It is concluded that the power density may be markedly increased if voids and channels are plugged with moderator material such as graphite or beryllium. (auth)

14600 JAERI-1002
Japan. Atomic Energy Research Inst., Tokyo.
DESIGN CALCULATIONS OF JRR-3 (NATURAL URANIUM HEAVY-WATER RESEARCH REACTOR). PART 2. CONTROL ROD AND SHIELD CALCULATIONS. Hiroshi Ishikawa, Takumi Asaoka, and Yutaka Sasakura. 1960. 124p.

Design calculations are described for JRR-3 control rods and shield. The equivalent reactivities of the control rods were calculated by the two group approximation, and it was found that the reactivity value which could be controlled by the twelve shim-safety rods is 10.7%. In the shield calculations, neutrons were treated by two group approximation and γ-rays were divided into three energy groups, i.e., 8, 5, and 2 Mev. The build-up factor of γ-rays is discussed in detail by the adaptation of the "moment method." The shield calculations of the various regions of the reactor, such as the experimental holes, water-gas system, fuel-handling system, etc., as well as the unit shield surrounding the reactor, were performed under the condition that the radiation level everywhere must be less than one-tenth of the maximum permissible dose, 300 mrem/week. (auth)

14601 NYO-9055
Rensselaer Polytechnic Inst., Troy, N. Y.
DESIGN, CONSTRUCTION, AND OPERATION OF A PULSED SUBCRITICAL URANIUM ASSEMBLY FOR EDUCATIONAL USES. Final Report. Dec. 31, 1959. 81p. Contract AT(30-3)-294. OTS.

The design, construction, and operation of a sub-critical assembly, intended for college teaching of reactor physics and of associated nuclear phenomena, are described. (W.D.M.)

14602
THE SAFETY SYSTEM OF THE GEESTHACHT RESEARCH REACTOR. G. Röbert (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht, Ger.). Kerntechnik 2, 81-9(1960) Mar. (In German)

After a brief description of the instrumentation, the mode of action of the individual safety functions in the operation of the reactor (scram rod circuit, scram circuit, automatic reversal, acoustical alarm) is explained. The conditions for the release of the safety system are discussed. The interlock system connected with the safety system is discussed in detail together with the conditions for the engaging of the holding magnet current. The grounds for the selection of the individual conditions in the interlock system are represented. The assumptions for the design of the shim rods and for the engaging of the automatic control are described. (tr-auth)

14603
DESIGNING HIGH-PRESSURE IN-PILE TEST THIMBLES. Max A. Vogel (Westinghouse Electric Corp., Pittsburgh). Nucleonics 18, No. 5, 116-21(1960) May.

Prime considerations are discussed which apply to the design of thimbles for the Westinghouse Testing Reactor and the Materials Testing Reactor. These are general shape and mechanical design, material selection, pressure and thermal stresses, ASME code considerations, hydraulics and heat transfer, and shielding. Both thimbles are designed to operate at 2,000 psi and 600°F and are of a size which makes them interchangeable with fuel assemblies. (B.O.G.)

WASTE DISPOSAL AND PROCESSING

14604 CF-60-4-17
Oak Ridge National Lab., Tenn.
REMOVAL OF Cs^{137}, Sr^{90}, AND Ru^{106} FROM ORNL PLANT WASTES BY SORPTION ON VARIOUS MINERALS. S. J. Rimshaw and D. C. Winkley. Apr. 1960. 43p. Contract W-7405-eng-26. OTS.

A series of minerals (120) were tested as to their efficiency in removing Cs^{137}, Sr^{90}, and Ru^{106} from dilute alkaline wastes prior to ground disposal. Strontium-90 exchanged rapidly with calcium in Florida pebble phosphate. The best results were obtained with Tennessee phosphate heated to 600°C for one hour, but part of the increase in sorption of strontium was due to ion exchange. Heating Tennessee phosphate resulted in a material with excellent hydraulic properties that sorbed Cs^{137} and Sr^{90} from dilute alkaline solutions. Other calcium minerals such as calcite or dolomite were activated to adsorb Sr^{90} by heating or by treating with caustic or phosphate solutions. Cesium-137 in dilute alkaline solutions exchanged preferentially with the potassium present in a number of mica schists and mica minerals which possess a layer lattice type of structure. The high selectivity for cesium of Tennessee phosphate heated to 600°C for one hour is ascribed to the presence of bentonitic impurities present in this material. The kinetics and adsorption of Ru^{106} are shown to be complex and slow due to the large number of chemical forms and complexes of ruthenium which can exist under varying conditions. Copper in conglomerate, various sulfide minerals containing copper, cuprite (cuprous oxide), and descloizite (basic zinc lead vanadate) removed 90% of the ruthenium under reducing conditions at a pH of 7 when heated at 60°C for 16 hours. At lower temperatures (25°C) the removal of ruthenium from aged solutions took days or even weeks. (auth)

14605 CRL-59
Atomic Energy of Canada Ltd., Chalk River, Ont.
WASTE MANAGEMENT AND MONITORING AT CHALK RIVER. C. W. Mawson, A. E. Russell, I. L. Ophel, A. R. Jones, W. F. Merritt, and P. J. Parsons. Nov. 1959. 50p. (AECL-987). AECL.

Four Papers Presented at the International Atomic Energy Agency Conference on Waste Disposal, Monaco, November 1959.

Facilities and equipment for use in the waste disposal program at Chalk River are described. Monitoring of fresh waters used in waste disposal is discussed along with gamma monitoring of land surfaces and sampling devices for water and soil. (J.R.D.)

14606 IDO-14502
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TREATMENT, PROCESSING AND FUTURE DISPOSAL OF RADIOACTIVE WASTES AT THE IDAHO CHEMICAL PROCESSING PLANT. James I. Stevens. Mar. 7, 1960. 44p. Contract AT(10-1)-205. OTS.

Presented at the Conference on Disposal of Radioactive Wastes Sponsored by the International Atomic Energy Agency November 16–21, 1959, in the Principality of Monaco.

Acidic wastes from the recovery of enriched U from Al, Zr, and stainless steel fuels at the Idaho Chemical Processing Plant are stored in underground tanks of two configurations and nominal sizes of 30,000 and 300,000 gallons. The design and operation of the waste tank form as well as the methods of environmental disposal of low level wastes are described. The latest information on corrosion rates in tanks and a comparison of design and operating data are presented. (auth)

14607 TID-5765
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
WASTE DISPOSAL RESEARCH AND DEVELOPMENT IN THE URANIUM MILLING INDUSTRY. Jan. 8, 1959. 9p. Contract AT(49-6)-924. OTS.

A review of waste disposal methods and the extent of chemical pollution from uranium mills are presented. Methods of alleviating chemical pollution are investigated and recommendations for further research are discussed. (J.R.D.)

14608 NP-tr-421
THE STORAGE OF RADIOACTIVE WASTES IN ARID AREAS. L. von Erichsen. Translated by M. C. Hartnell-Beavis (U.K.A.E.A. Atomic Energy Research Establishment) from Atomkernenergie 4, 112-15(1959). 15p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13995.

14609
RADIOACTIVE WASTES. V. RADIOACTIVITY INVESTIGATIONS OF WATER. H. J. B. de Regt. Atoomenergie 2, 53-7(1960) Apr. (In Dutch)

The ways in which contamination of the upper water surfaces with radioactive materials occurs are shown. Methods for the preliminary processing and the difficulties which are apt to arise under such conditions are indicated. Moreover, the importance of developing apparatus capable of measuring low activities is discussed. (tr-auth)

14610
TEMPERATURE RISE IN UNDERGROUND STORAGE SITES FOR RADIOACTIVE WASTES R. S. Schechter (Univ. of Texas, Austin) and E. F. Gloyna. Chem. Eng. Progr. 55, Symposium Ser. No. 27, 117-24(1959).

The limits of the temperature increase which result from the release of energy by high-level radioactive wastes stored in underground spherical cavities is determined by calculating the temperature rise on the basis of two models, one fixing the upper limit of temperature increase and the other the lower limit. The results of these calculations are presented in a generalized graphical form to facilitate design calculations. (auth)

DEPOSITORIES OF USAEC REPORTS IN NON-U.S. LIBRARIES

The libraries at the organizations listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institut der Universität
Vienna, International Atomic Energy Agency

BELGIAN CONGO
Leopoldville, Université Lovanium

BELGIUM
Brussels, Centre d'Études pour les Applications de l'Energie Nucléaire
Brussels, La Bibliotheque EURATOM

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao

BURMA
Rangoon, Union of Burma Applied Research Institute

CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Ministerio de Relaciones Exteriores

CHINA
Hsinchu, Formosa, National Tsing Hua University Library

COLOMBIA
Bogotá, Comision de Energia Atomica de Columbia

COSTA RICA
San Pedro, University of Costa Rica Library

CUBA
Havana, Comisión de Energía Nuclear de Cuba

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace

ECUADOR
Quito, Escuela Politécnica Nacional

EGYPT
Cairo, Atomic Energy Commission

EL SALVADOR
San Salvador, Universidad Nacional, Facultad de Ingenieria

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
Paris, Organization for European Cooperation, Nuclear Energy Library

GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

GHANA
Accra, University College of Ghana

GREECE
Athens, Greek Atomic Energy Commission

GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

HONDURAS
Tegucicalpa, Comisión Hondureña de Energía Atómica

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

INTER-AMERICAN NUCLEAR ENERGY COMMISSION
Washington, D. C., Pan American Union

IRAN
Tehran, Tehran University Center for Nuclear Studies

IRAQ
Baghdad, Iraqi Atomic Energy Commission

IRELAND
Dublin, University College

ISRAEL
Tel Aviv, Israel Atomic Energy Commission

ITALY
Milan, Centro di Studi Nucleari di Ispra del C.N.R.N.
Rome, Comitato Nazionale per le Ricerche Nucleari

JAPAN
Tokyo, Science Section, Diet Library

KOREA
Seoul, Atomic Energy Research Institute

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, Department of Industrial and Forensic Science

NORWAY
Lilleström, Institutt för Atomenergi

PAKISTAN
Karachi, Atomic Energy Commission

PERU
Lima, Biblioteca Nacional

PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission

POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej

PORTUGAL
Lisbon, Junta de Energía Nuclear

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear

SWEDEN
Stockholm, Atomenergi AB

SWITZERLAND
Geneva, United Nations Library
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

UNION OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library, Council for Scientific and Industrial Research

UNITED NATIONS
New York, N. Y., U.N. Headquarters

URUGUAY
Montevideo, Universidad de Montevideo

VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Cientificas

VIET-NAM
Saigon, Office of Atomic Energy

YUGOSLAVIA
Belgrade, Federal Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

TECHNICAL PROGRESS REVIEWS

The U. S. Atomic Energy Commission, Office of Technical Information, publishes an unclassified series of Technical Progress Reviews which provide concise summaries of current atomic developments. Issued quarterly, each of these Technical Progress Reviews digests and evaluates the latest findings in a specific area of nuclear technology and science. The Reviews also report on technology developed in military reactor and other classified AEC programs to the extent that the technology can be dissociated from sensitive military and production data.

The four journals published in this series are:

Nuclear Safety, W. B. Cottrell, editor, R. A. Charpie, advisory editor, and associates, Oak Ridge National Laboratory

Power Reactor Technology, Walter H. Zinn and associates, General Nuclear Engineering Corporation

Reactor Core Materials (covering solid material developments), R. W. Dayton, E. M. Simons, and associates, Battelle Memorial Institute

Reactor Fuel Processing, Stephen Lawroski and associates, Chemical Engineering Division, Argonne National Laboratory

Each journal may be purchased by subscription (domestic, $2.00 a year; foreign, $2.50 a year) or by individual issue (55¢) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.